4. POLLUTANT STATISTICS AND RELATIONSHIPS BETWEEN POLLUTANT AND
METEOROLOGICAL PARAMETERS DURING THE VCOT STUDY

In this section we describe the spatial and temporal distribution of
ozone daily maxima during the VCOT study. In addition, data summaries,
plots, and correlations are presented which show the relationships between
these daily maximum ozone concentrations and various meteorological
parameters. These relationships were used to assess the meteorological
conditions under which high Ventura County ozone concentrations and Los Angeles
to Ventura County ozone transport occurred. Most of the data used to prepare
the plots and summaries in this section are included in tabular form in
Appendix A.

4.1   VENTURA COUNTY OZONE CONCENTRATION STATISTICS DURING THE STUDY PERIOD

The VCOT study was designed to look for the effects of Los Angeles
to Ventura County pollutant transport on Ventura County ozone concentrations.
The September time period was chosen since transport conditions are likely
during that month and since exceedances of the ozone standard in the coastal
regions typically occur during that time. The study was also designed to
examine the effects of elevated ozone layers on surface concentrations. Even
though the meteorology of the study period had more than usual coastal
cloudiness and storm activity, we were fortunate in that the period was also a
time of high ozone concentrations in Ventura County with many "transport" days
and many days with elevated ozone layers over Ventura County.

For the VCOT study period, a set of surface ozone data was obtained
which included data from six sites from the VCAPCD network, a site operated by
CARB, plus elevated stations at Rocketdyne and Laguna Peak. These sites are
shown in Figure 1-1. The number of days and hours when exceedances of the
California and federal ozone standards occurred at these sites during the
study period are listed in Table 4-1. The frequencies of occurrence of ozone
maxima for each site are plotted in Figure 4-1. It is apparent that the
highest number of hours of ozone exceedances occurred at those sites nearest
to the Los Angeles County boundary. It is also evident that elevated sites
(Rocketdyne, Laguna Peak, and Ojai) even near the coast, experienced
substantial periods of high ozone.

As indicated in Section 3 and further discussed in Section 4-2, the
1000 PST Pt. Mugu winds at about 3000' msl are a reasonable indicator of the
potential for transport between Los Angeles and Ventura County. Using wind
directions between 045^{0} and 180^{0} as the criteria for transport, 21 of
the 26 days that the mid-morning Pt. Mugu soundings were made during the study
period were potential transport days.

The median times for those hours during the study period when the
ozone concentration at each site exceeded 12 pphm are shown on the map in
Figure 4-2. From Figure 4-2 we can see that the periods of high ozone
occurred in midday in the eastern part of the county; yet in the coastal
regions, the high ozone concentrations occurred in mid to late afternoon.
These times of high ozone occurrence are consistent with the large number of
days of potential transport from Los Angeles to Ventura County which

Table 4-1. Ozone Levels for September 1 - October 6, 1983

SITE	# HOURS >10 pphm*	>12 pphm**	# DAYS >10 pphm	>12 pphm	PEAK CONCENTRATION
La Conchita (CARB)	0	0	0	0	10
Ventura (VCAPCD)	14	6	4	3	15
El Rio (VCAPCD)	10	6	3	2	14
Thousand Oaks (VCAPCD)	31	8	10	4	18
Ojai (VCAPCD)	31	10	9	3	15
Simi (VCAPCD)	72	28	16	11	23
Piru (VCAPCD)	49	12	14	6	17
Rocketdyne	106	64	18	15	28
Laguna Peak	38	20	10	7	17

* California Standard
** Federal Standard
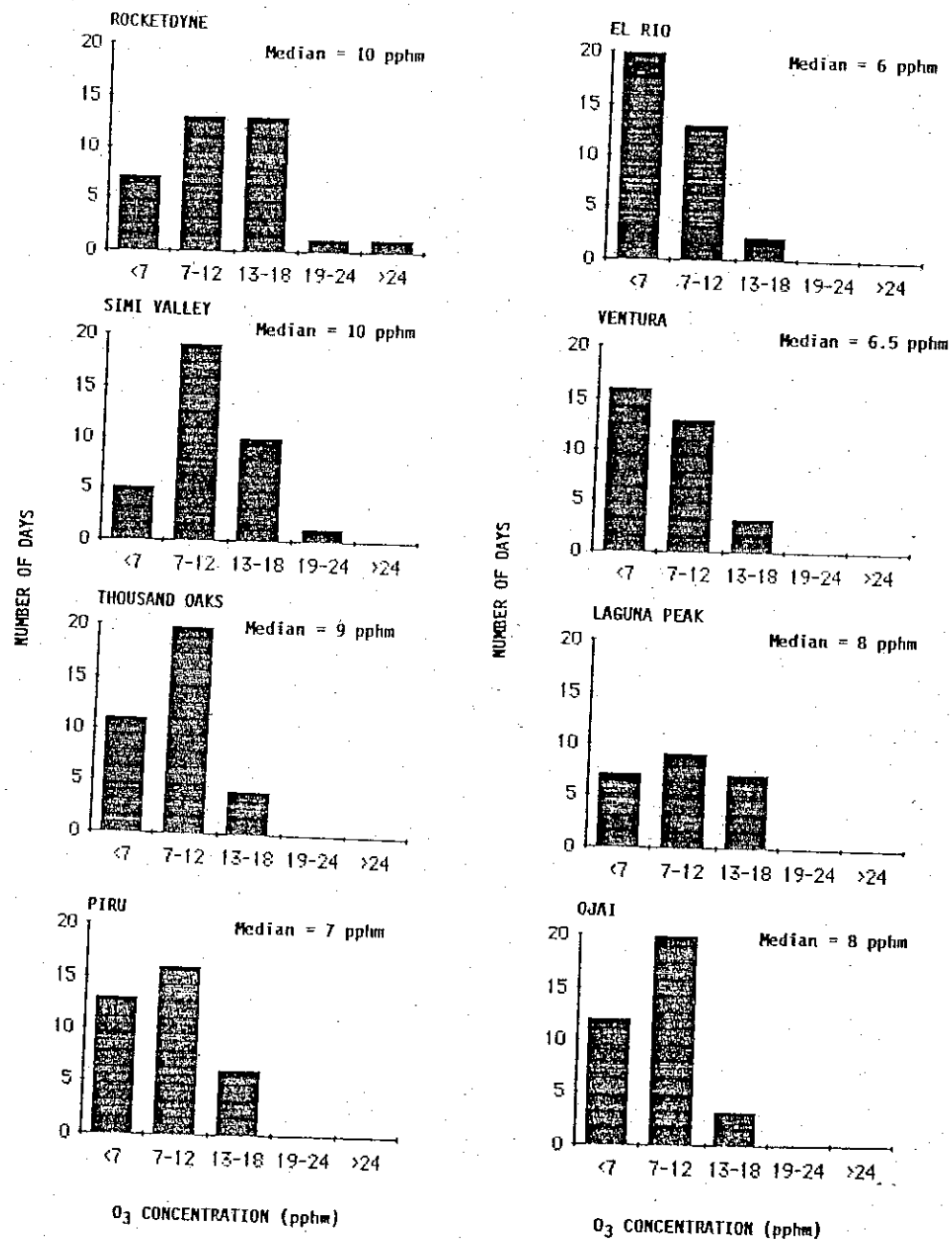
Figure 4-1. Frequency of Occurrence of Ozone Maxima from September 1 - October 6, 1983.

Figure 4-2. Median Times (PST) for Hours Exceeding 12 pphm Ozone.
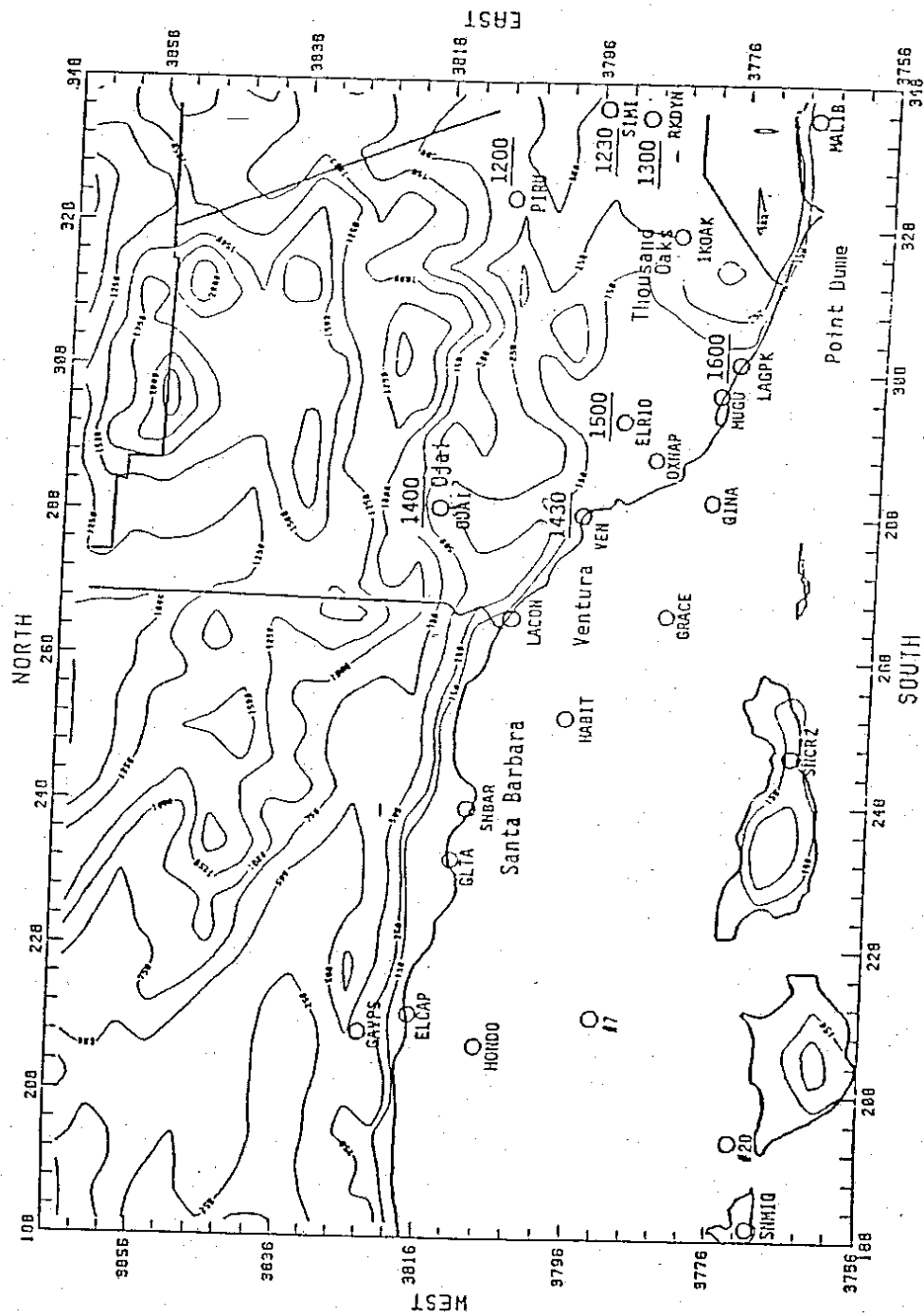
occurred during the study period (e.g. Figure 3-3 for September 11, 1983). Transport along the inland route results in midday peak concentrations in eastern Ventura County while transport along the coastal route takes longer and results in later ozone peaks in the coastal regions.

The ozone concentrations measured aloft during the three daily aircraft soundings are summarized in Table 4-2. All of the routine sounding locations frequently had elevated layers of ozone, and the median altitude of peak ozone concentrations was well above the surface at all locations. Days when surface ozone concentrations in Ventura County exceeded 12 pphm typically had higher ozone concentrations aloft than non-exceedance days, and elevated layers were measured on all exceedance days. (See Table 3-20).

4.2   RELATIONSHIPS BETWEEN VARIOUS POLLUTANT AND METEOROLOGICAL PARAMETERS

The high ozone days (> 12 pphm) in Ventura County had several noticeable characteristics. As seen in Figure 1-3, the 850 mb temperature was typically higher than 20°C, indicating a regional high pressure condition. For the study period, the correlation between the Ventura County daily maximum hourly ozone concentration and the morning 850 mb temperature at Vandenberg AFB was 0.80. A scatterplot of the ozone and 850 mb temperature data is presented in Figure 4-3. The maximum ozone concentrations in Ventura County were also well correlated with the maximum concentrations at the four nearest Los Angeles County stations, again indicating a regional situation. Figure 4-4 is a scatterplot of the maximum hourly ozone concentration in Ventura County plotted against the maximum concentration at Lennox, West Los Angeles, Reseda, or Burbank. The correlation is 0.78 between the Ventura County and Los Angeles County sites. The correlation between the same Ventura County data and the maximum ozone at the four upwind sites for the previous day is still 0.76, as shown in Figure 4-5.

Another characteristic of high ozone days in Ventura County was that ozone layers aloft typically existed on these days along with an easterly flow component aloft. In addition, the mixing was confined below 3000' msl and the boundary layer background ozone concentrations were relatively high, typically from 5 - 9 pphm. These conditions are indicated in Figures 4-6 – 4-9 which are scatterplots of maximum surface ozone in the VCOT data set plotted against ozone in upper layers, wind direction aloft, mixing height, and background ozone aloft in the region (typically at approximately 3000' msl). The upper air data for Figures 4-6 through 4-9 were obtained from the aircraft soundings and from the Pt. Mugu rawinsondes.

The analyses above indicate that high ozone concentrations in Ventura County during the study period were associated with high pressure conditions and with regional pollution episodes which also encompassed Los Angeles County. The association of high ozone in Ventura County with an easterly flow component aloft (Figure 4-7) indicates that some of the high ozone in Ventura County was likely to be due to transport from Los Angeles County. The association with ozone in elevated layers (Figure 4-6) is also important to note. During the study, the maximum ozone concentrations measured on exceedance days occurred at an elevated site (Laguna Peak or Rocketdyne) on all days but one. As noted in Section 3, these layers often have their origins to the east and southeast and are available to be mixed to the surface. To further assess the transport issue, we examined the surface and elevated wind fields during the study period.

Table 4-2.   Summary of Ozone Soundings Median Peak Concentrations (pphm) and Heights (m msl).

LOCATION	TIME (PST)		
	05	10	15
#1* Camarillo	6 pphm 725 m msl	12 500	14 550
#2 (3 mi. S of Laguna Peak)	7 675	11 625	13 400
#3 (13 mi. S of Laguna Peak)	7 400	10 425	11 400
#7 (Westlake)	8 800	13 625	11 800
#9 (Simi)	8 825	15 700	15 800

* See Figure 1-2 for spiral locations
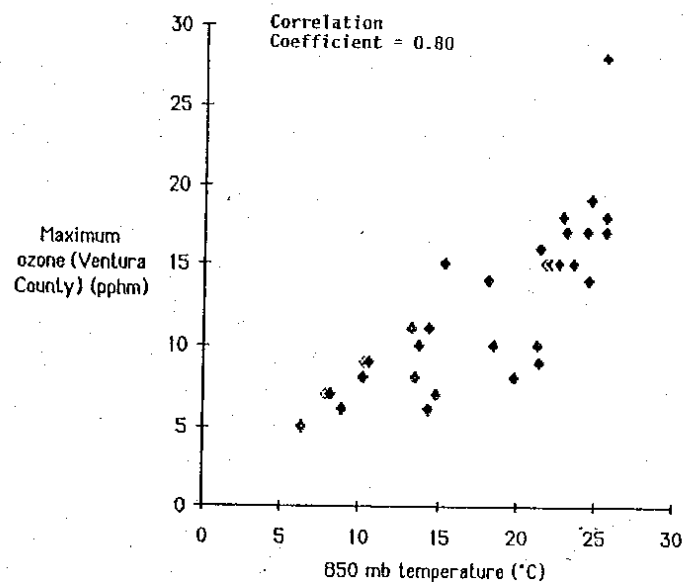
Figure 4-3.   Ventura County Maximum Ozone vs. 850 mb Temperature at Vandenberg AFB.
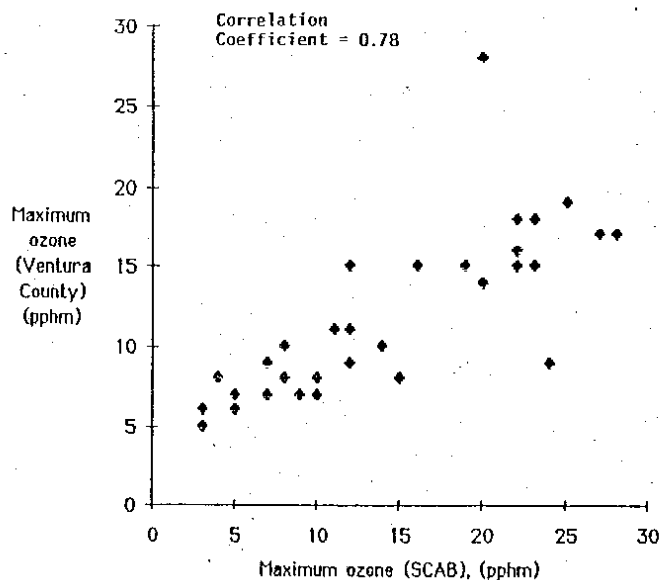
Figure 4-4. Ventura County Maximum Surface Ozone vs. Maximum Ozone at Four Upwind (SCAB) Sites During VCOT Study. (Ventura County sites include Rocketdyne and Laguna Peak.)
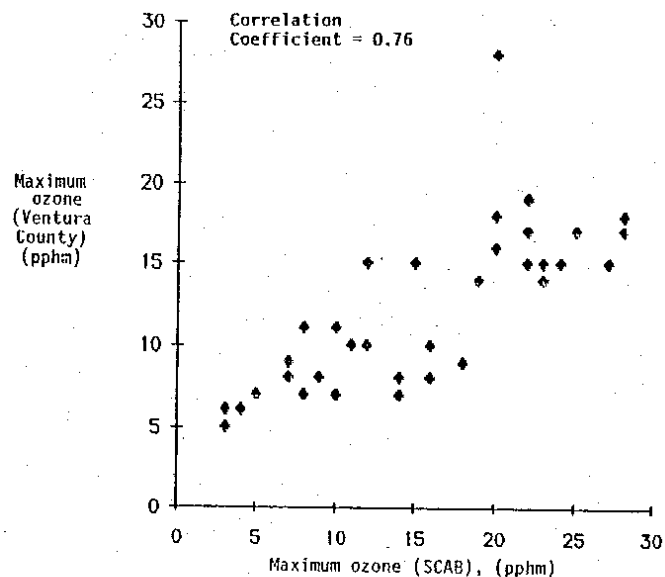
Figure 4-5. Ventura County Maximum Surface Ozone vs. Maximum Ozone from Previous Day at Four Upwind (SCAB) Sites During VCOT Study. (Ventura County sites include Rocketdyne and Lagune Peak.)
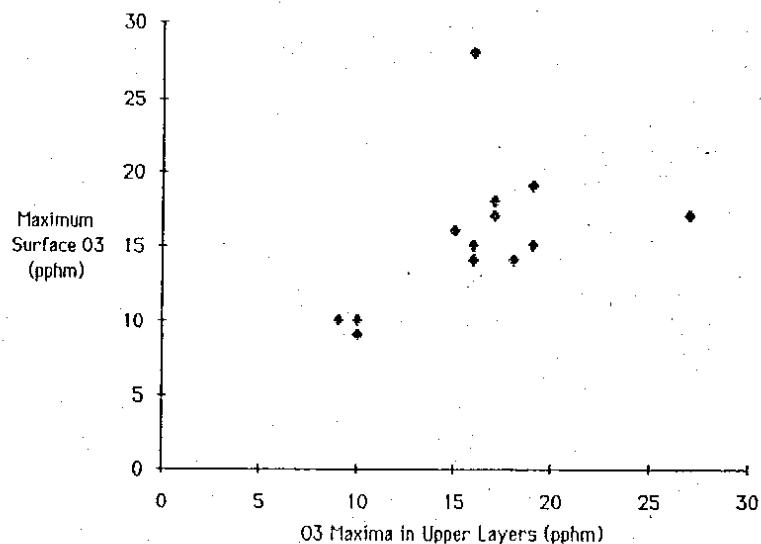
Figure 4-6. Surface O₃ Maxima vs. Maximum concentration in Early Morning or Midday elevated Layers. (September 1 - 20, 1983 data only.)
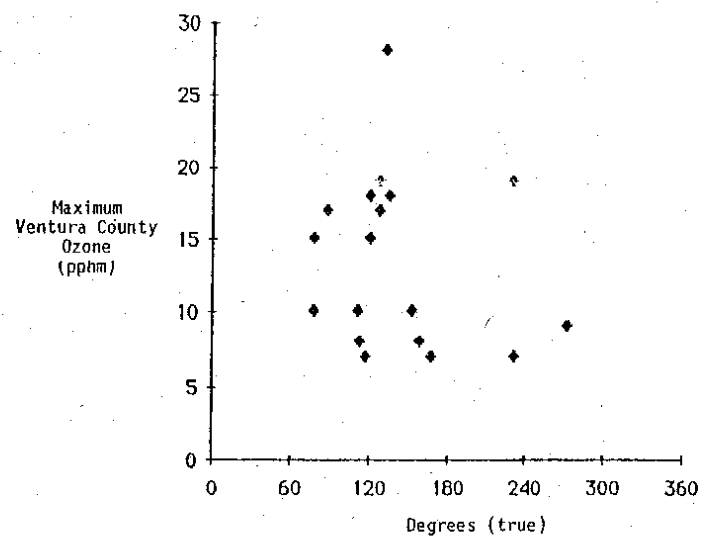
Figure 4-7. Maximum Daily Hourly Average Ozone Concentration vs. Wind Direction at 3000' msl from the Midmorning Pt. Mugu Radiosonde during the VCOT Study.
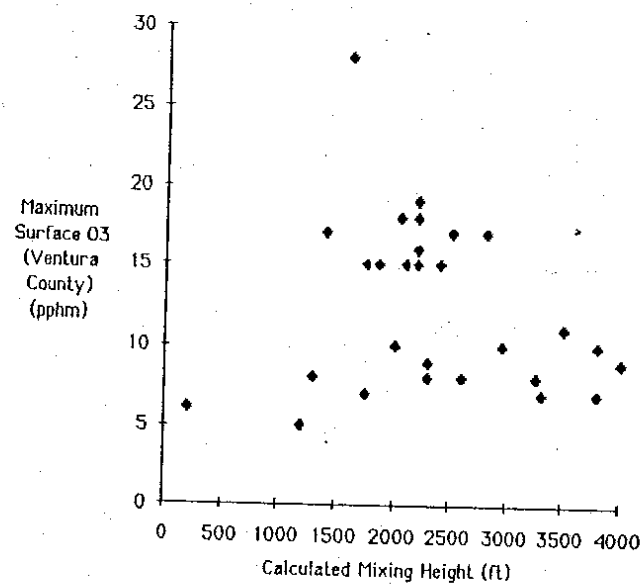
Figure 4-8. Maximum Surface Ozone vs. Maximum Mixing Height. (Calculated from the early morning Point Mugu radiosonde and the maximum surface temperature at Simi.)
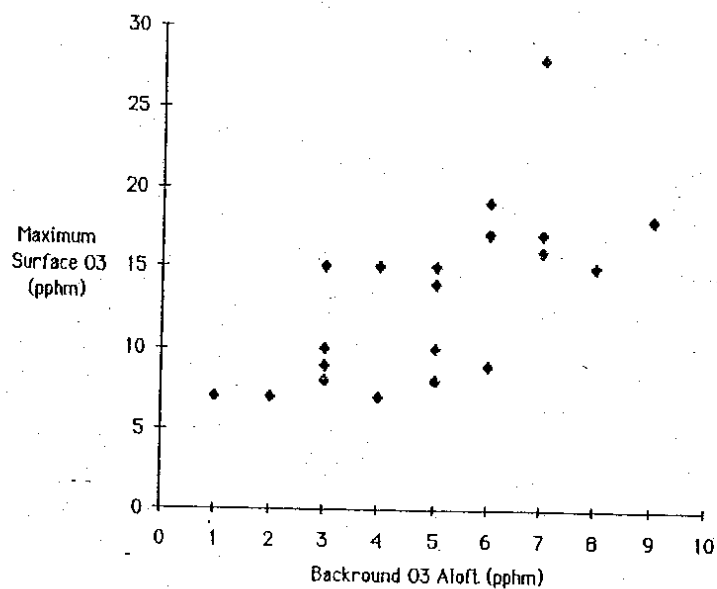
Figure 4-9. Surface Peak Ozone vs. Background Ozone in Ventura County During the VCOT Study. (Background ozone was obtained from the aircraft sounding data at the top of the regional boundary layer (~3000'.)

The prevailing streamlines for the 0600-0800 PST hours during days when maximum ozone concentrations > 12 pphm were observed in Ventura County are shown in Figure 4-10. These streamlines are estimated from the most frequent wind directions and the average speed for those directions. The surface flows over land show a general easterly to southeasterly flow, and the elevated locations show a southeasterly flow. These flows indicate transport from Los Angeles to Ventura County both at the surface and aloft on high ozone days during the study period.

The ozone maxima for exceedance days (>12 pphm) at selected sites for the study period and the corresponding winds aloft at several locations are listed in Table 4-3. On all but one exceedance day, an easterly component was seen aloft in one of the upper air locations. On the one day that was an exception, the Ventura County upper winds were missing and the west Los Angeles upper wind was essentially calm.

To examine the source of the air which arrived at the monitoring sites during periods of high ozone, we calculated back trajectories using surface wind data. For the median times of peak ozone on exceedance days at four sites, back trajectories were calculated using the prevailing wind directions and average wind speeds. These trajectories are shown in Figure 4-11. These prevailing flows are consistent with the transport mechanisms described in Section 3.

The Piru trajectory shows an origin on the coastal plain in the early morning. This trajectory seems to indicate a potential Ventura County source for the ozone seen at Piru, but it does not exclude a transport component. As mentioned in Section 3, the elevated flows can be easterly even when the surface flows are westerly. As the surface air moves inland, the mixing layer deepens, and ozone from elevated layers with origins to the east can be entrained and mixed to the surface.

In summary, during the study, high ozone concentrations in Ventura County were typically associated with the following conditions:

- 850 mb temperatures above ~ 20°C
- background ozone aloft of 5-9 pphm
- layers of high ozone concentration above the surface in early morning or midday
- mixing depths below about 3000'
- an easterly component to the flow aloft

These conditions are typical of the high pressure systems which result in regional stagnation conditions. Although the same conditions would be conducive to a buildup of ozone in Ventura County with or without transport from Los Angeles County, it is apparent that substantial transport occurred during the study period. Since the study was designed to look for transport, it is likely that other parts of the summer may exhibit less transport, and less of an effect of transport on Ventura County ozone concentrations. These issues are examined further in Sections 5 and 6.

To establish the frequency of potential transport impact during periods other than the study period, it was necessary to select an easily obtained indicator of transport. We reviewed several potential indicators of
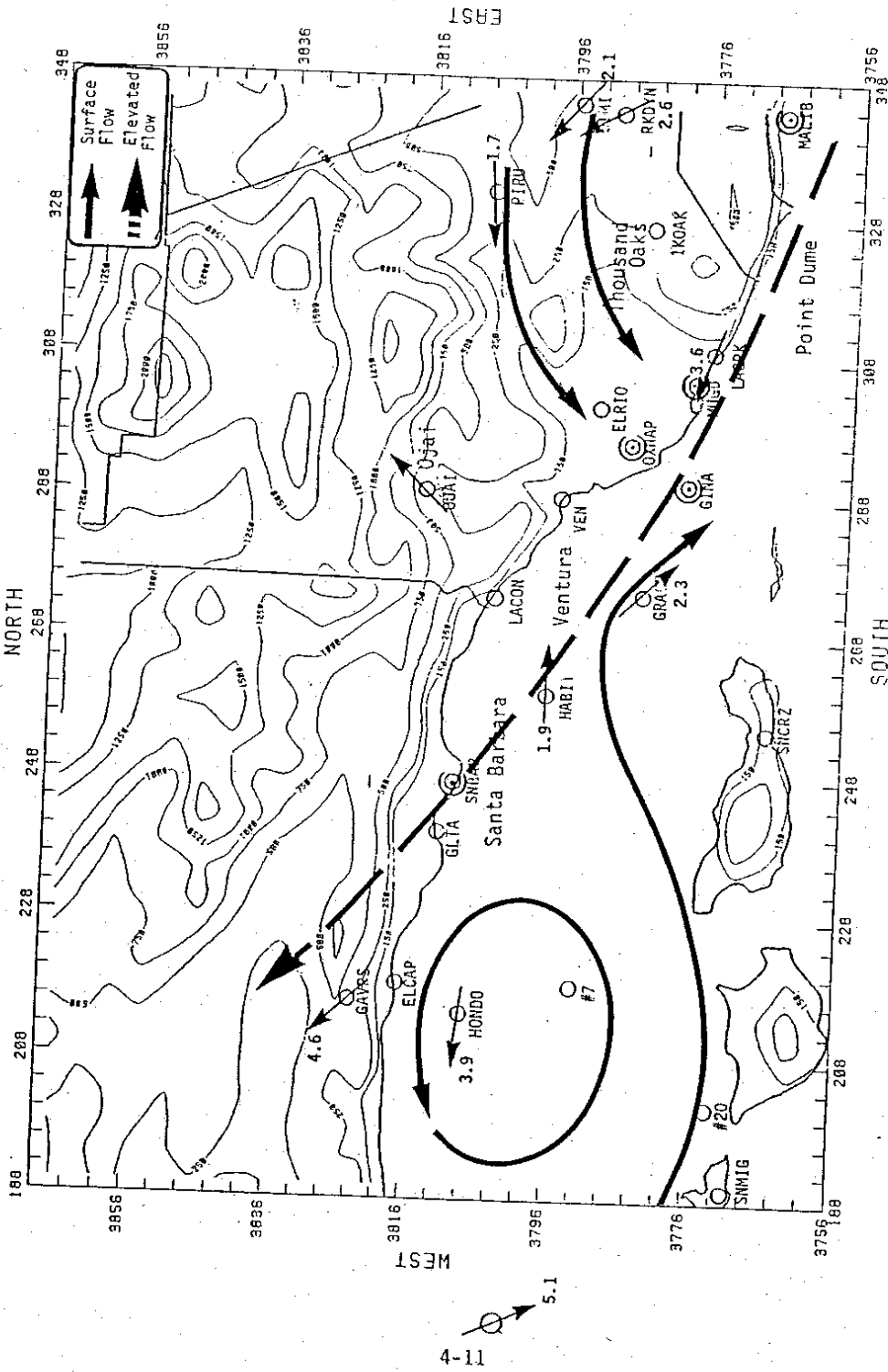
Figure 4-10. Prevailing Surface and Elevated Flow for High Ozone Days - 0600-0800 PST. (Wind speeds in m/s. C indicates calm.)

Table 4-3. Ozone Maxima and Upper Winds for Exceedance Days during the VCOT Study - September 1 - October 6, 1983.

Date	Coastal Exceedances (pphm)/(Time PST)			Inland Exceedances (pphm)/(time PST)				Marymont+ 0500 PST-1000mb	Winds Aloft (°True/m/s) Mugu - Mid AM 3000' msl	1000 PST Average Doppler Winds in Transport Layer
	Ventura	El Rio	Laguna Peak*	Simi	Rocketdyne*	Piru	Ojai			
Sept 3				13/11	15/11			098/0.5	M	99/8
4					14/12			305/0.5	M	-
5					16/11-13			125/0.5	M	-
6				15/13	17/13			200/1	128/4	-
7						13/12		220/1.5	130/4**	127/4**
Sept 10				14/10	15/10,12			155/1	M	164/6
11		14/15,16			14/14			140/0.5	M	127/13
12	15/12		13/11,12	23/13	28/12	17/12,13	14/15	070/2	132/2	128/10
13	13/15,16	13/13-16	14/19,20	16/12	18/11	15/12		205/1	120/1.5	-
14			14/11	15/11	19/11	14/12		080/1	230/0.5	161/3
15				15/13	17/12-13	13/12,13	15/13-15	M	128/1.5	137/2
16			17/20	15/12	14/10,12			240/1	088/2	118/4
17			15/22	17/13,14	18/11,12	14/13		090/1.5	135/0.5***	131/5
18		14/15	15/15	15/14	14/13,14		13/14	300/1	078/7.5	131/7
19	14/15		15/16		13/16			105/1	120/10.5.	90/2
Oct 4				15/12	14/13			045/3.5	M	55/12

* Elevated sites
** Inversion level winds
*** 1300 PST winds
+ Marymount soundings are made in West Los Angeles
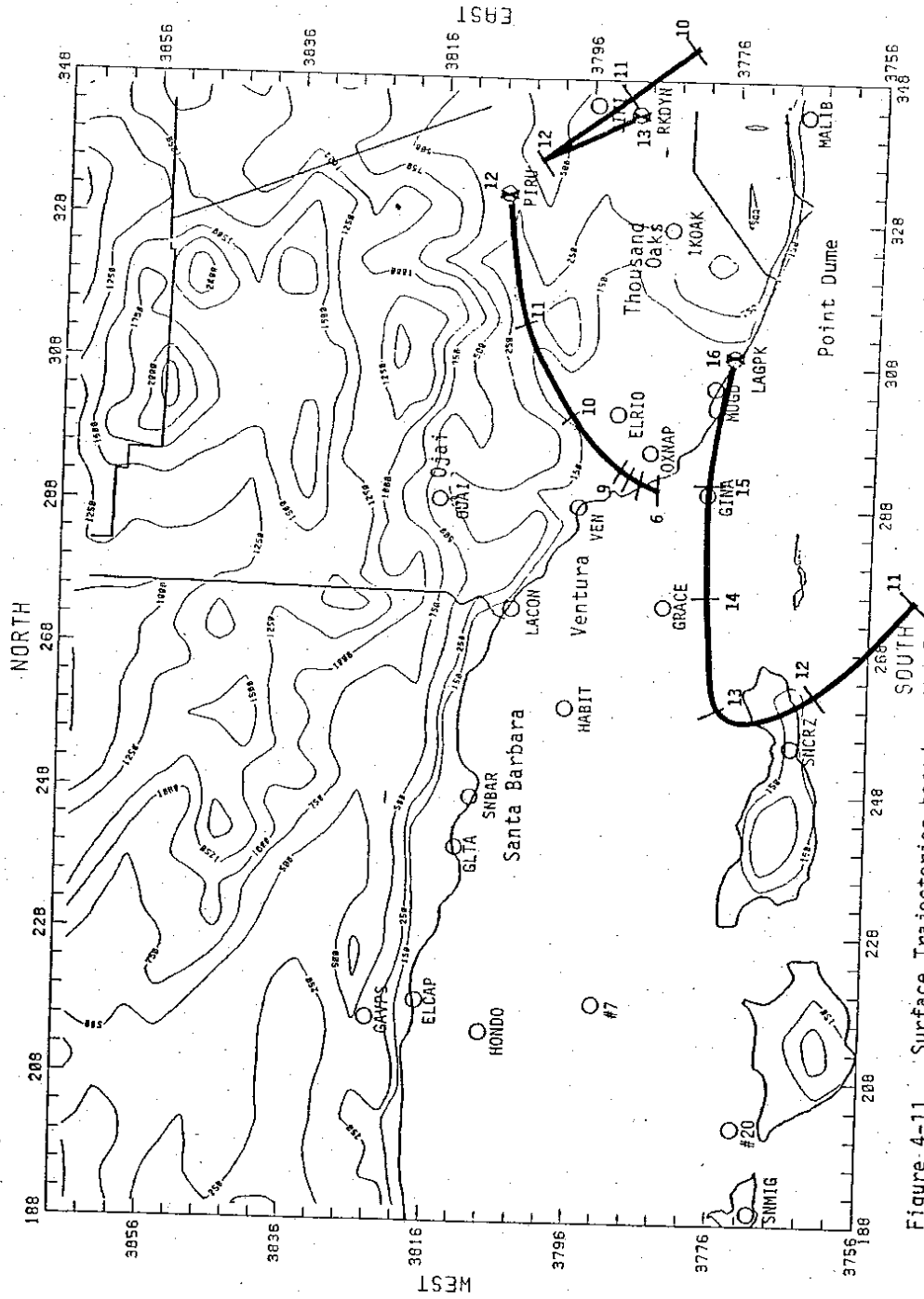
Figure 4-11. Surface Trajectories based on the Prevailing Winds for the Median Time of the Daily Ozone Maxima. (Times are in PST.)

transport such as the surface and elevated wind and various pressure
gradients. The most direct indicator of transport is naturally the wind
field. After examining the surface and upper air winds and their relation to
surface ozone concentrations during the study period, we selected the 3000'
wind direction from the Pt. Mugu 1000 PST rawinsonde as a good indicator of
potential transport. Wind directions between 45^0 and 180^0 were
assumed to indicate potential transport. This indicator was chosen for the
following reasons:

- The transport mechanisms described in Section 3 involve
  an easterly flow component at either the surface or aloft.
  Typically easterly flow at the surface during the day is also
  accompanied by easterly flow aloft, but the opposite is not
  necessarily true; thus an elevated wind measurement was chosen.

- The transport conditions identified in Section 3 involve transport
  during the late night and midday hours. The 1000 PST measurement
  represents the mid-point of the various transport periods. Using
  the same criteria to define transport potential for the early
  morning or mid-afternoon Pt. Mugu rawinsondes, those soundings were
  found to give the same result as the 1000 PST sounding on 73% and
  70% of the days, respectively, of a four year summer data set.
  Thus the 1000 PST sounding should be reasonably representative of
  the early morning through midday period.

- The 3000' msl altitude was chosen since this height is high enough
  to be out of the influence of local surface features and thus to
  be more regionally representative. Yet, it is low enough to
  still be near the top of the boundary layer flow. Determination of
  transport from the 3000' msl height gives the same result as the
  same determination from the 2000' msl height on 81% of the days
  in the four year data set mentioned above.

- The 45^0 to 180^0 directional criterion was used since those
  directions encompass virtually all of the trajectory directions
  from which material is likely to be transported from Los Angeles
  to Ventura County.

While the 3000' msl wind is suggested as an indicator of potential
transport from Los Angeles County, the impact of the transport on Ventura
County ozone concentrations is determined largely by the depth of the mixing
layer which, in turn, is strongly influenced by the temperatures aloft
(e.g. 850 mb).

5. RELATIONSHIPS OF HIGH OZONE IN VENTURA COUNTY TO
   TRANSPORT AND METEOROLOGICAL CONDITIONS.

5.1 DATA BASE USED TO EXAMINE POLLUTANT - METEOROLOGICAL RELATIONSHIPS
     AND TO ASSESS REPRESENTATIVENESS

     In order to test hypotheses and examine relationships suggested by the
September 1983 data and to evaluate the representativeness of the September
1983 field sampling period, a four year data base was assembled. This data
base consists of daily records of the following parameters for June through
October from 1980 to 1983:

     - Daily hourly ozone maxima for each Ventura County APCD network
       site and for Rocketdyne (1981-1983 only).

     - Daily maxima of the hourly average ozone concentrations measured
       at any Ventura County site including Rocketdyne.

     - Daily ozone maxima for Los Angeles County monitoring sites at
       Lennox, West Los Angeles, Reseda, and Burbank.

     - The 1000', 2000', and 3000' wind speed and direction at the
       Point Mugu Pacific Missile Test Range for the 0400 PST,
       1000 PST, and 1600 PST observations.

     - The 500', 1000', 2000', and 3000' wind speed and direction
       in the western Los Angeles Basin for the 0500 PST and 1100 PST
       observations (6/80 - 7/82 at UCLA/Westwood; 8/82 - 10/83 at
       Loyola-Marymont).

     - The 850 mb temperature and height at Las Vegas (Bottle Rock)
       and Vandenberg AFB from the 0400 PST observations, and

     - The 0400 PST surface pressure gradients from San Francisco to
       Reno and from Eureka to Reno.

     In this section, this data base is used to examine the relationships
of Ventura County ozone concentrations to meteorological parameters and to
assess the contribution of intercounty transport to Ventura County ozone
concentrations. In Section 6, the representativeness of the 1983 field
sampling period compared to the long-term data base is examined. Some aspects
of the four year data base have also been discussed in Section 3. Most of
the data used in Sections 5 and 6 are listed in Appendix B.

     The plots and tables in Sections 5 and 6 which use the data from
Appendix B will have varying numbers of data points. For example, the number
of data points available when stratifying by the Vandenberg 850 mb
temperature will be different than when stratifying by the upper air wind
direction at Pt. Mugu since the number of soundings at Pt. Mugu and
Vandenberg are different.

5.2 RELATIONSHIP OF OZONE WITH 850 MB TEMPERATURE

     Atmospheric stability is directly related to the temperature lapse
rate. A rapid decrease in temperature with height is associated with

instability. Conversely weak, isothermal, and inverted (increase with height) lapse rates are associated with stable air. The temperature at 850 mb (about 1500 m) is widely used in California as an indicator of lapse rate, and hence regional air mass stability. With warm 850 mb temperatures, the vertical dispersion of pollutants is limited, thus, increasing the concentrations in the boundary layer.

The relationship of ozone levels to 850 mb temperature is clearly illustrated on Figures 5-1 and 5-2 and in Table 5-1. Figure 5-1 shows the frequency distribution of the 0400 PST Vandenberg 850 mb temperatures for the complete data set stratified by whether or not the federal ozone standard (12 pphm) was exceeded in Ventura County. From Figure 5-1, the most frequent temperature range increases from 16-18°C on non-exceedance days to 22-24°C on exceedance days. Figure 5-2 is a scatterplot of the 850 mb temperature versus the peak daily ozone maxima in Ventura County. Although the data exhibit a lot of variability, an increase of ozone concentration with temperature is evident. Even though the relationship between the variables is probably not linear, the linear regression line for the two variables is included in Figure 5-2 for reference purposes. Based on this regression line, an 850 mb temperature above about 20°C typically is associated with exceedance days ($O_3 > 12$ pphm). The cumulative frequencies and averages of the 850 temperatures are given in Table 5-1. The average 850 mb temperature increases from 15.2°C on non-exceedance days to 21.2°C on exceedance days. Note that the 850 mb temperature was above 20°C on only 17% of the non-exceedance days as opposed to 66% of the exceedance days.

Table 5-1. Cumulative Frequencies of 0400 PST 850 mb Temperatures at Vandenberg for Ventura County Exceedance and Non-Exceedance Days (1980-1983)

850 mb Temp ($^\circ$C)	Cumulative Frequency (%)	
	$O_3 \leq 12$ pphm	$O_3 > 12$ pphm
<10.0	16.2	0
<12.0	24.8	0
<14.0	39.5	0.4
<16.0	54.8	6.8
<18.0	72.6	19.6
<20.0	82.8	34.3
<22.0	92.4	55.1
<24.0	98.1	80.0
<26.0	99.4	92.5
<28.0	100.0	100.0
>28.0	100.0	100.0
Average Temperature	15.2°C	21.2°C

5.3 RELATIONSHIP BETWEEN VENTURA COUNTY OZONE CONCENTRATIONS AND THE OCCURRENCE OF TRANSPORT FROM LOS ANGELES TO VENTURA COUNTY

The processes by which pollutants from Los Angeles County contribute to ozone concentrations in Ventura County were described in Section 3. These transport processes were observed to occur on numerous occasions during the VCOT field study. However, the VCOT study was designed to look for such transport. To examine the frequency of occurrence of Los Angeles to Ventura

Figure 5-1. Frequency of Occurrence of 0400 PST 850 mb Temperatures at Vandenberg AFB for Exceedance and Non-exceedance Days in Ventura County for June-October, 1980-1983.
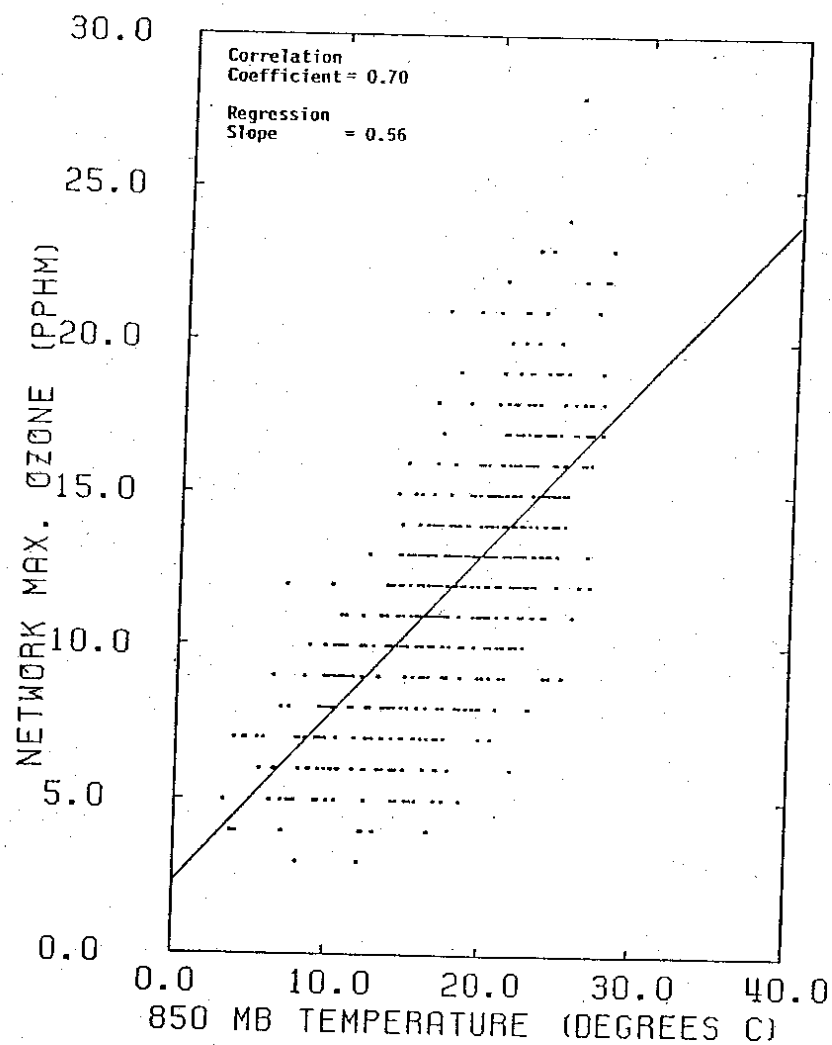
Figure 5-2. Ventura County Network Daily Maximum Hourly Ozone Concentrations as a Function of the 0400 PST Vandenberg AFB 850 mb Temperature for June-October, 1980-1983. (Note that the slope of the regression line visually appears too low. The line is correct, but is strongly influenced by variations in the density of points, especially those above the line between 10 degrees and 20 degrees C).

County transport over a longer time period and to get an idea of the transport contributions to Ventura County ozone concentrations, the 1980-1983 data base described in Section 5.1 was assembled, and the "transport" indicator described in Section 4.2 was selected.

Numerous analyses were performed on the four year data base to try to distinguish the effects of transport on specific monitoring stations and on Ventura County as a whole. From these analyses, we have found that there was the potential for transport on over half of the summer days in our data set and that the average ozone concentrations were higher at most Ventura County sites on "transport" days than on "non-transport" days. Selected analyses which demonstrate the frequency and effects of transport and the characteristics of transport days are presented in this section.

5.3.1 Frequency of Occurrence of "Transport" Days

As described in Section 4.2, we chose the 1000 PST 3000' wind direction at Pt. Mugu as an indicator of transport. Directions between 45° and 180° true were assumed to indicate transport. On most days, a positive occurrence is indicative of a regional boundary layer flow from Los Angeles to Ventura County during the morning hours. Even with this general flow however, surface sites might experience transport from a different direction due to terrain and thermally driven land-sea breeze influences.

Based on our "transport" indicator, the frequencies of occurrence of potential transport for the summer months in the four year data set are shown in Table 5-2. From this table, we can see that the potential for transport existed on half or more of all the days in each month and that August and September experienced a substantially higher frequency of transport than the other months. From this indicator, it is clear that the boundary layer air frequently flows from Los Angeles to Ventura County and that the transport phenomena should not be ignored when developing strategies for pollutant control in Ventura County.

Table 5-2. Frequency of Occurrence of Los Angeles to Ventura County
Transport Winds. (Based on 1000 PST 3000 ft. Pt. Mugu
rawinsonde data from 1980-1983.)

Month:	June	July	August	September	October	TOTAL
% of Days for $45^o \le WD \le 180^o$	50	52	71	69	51	59

5.3.2 850 mb Temperature Characteristics of "Transport" and "Non-Transport" Days

In Section 5.2, a strong relationship was shown between the morning 850 mb temperature and the daily maximum ozone concentration in Ventura County. In trying to distinguish the effects of transport phenomena on ozone concentration, it is important not to confound the effects of transport with other effects such as low mixing heights or trapping. Thus we have examined the relationship of 850 mb temperature to the occurrence of "transport" days. Figure 5-3 presents the frequency of 0400 PST 850 mb temperatures at Vandenberg for "transport" and "non-transport" days in the four year data base. From this figure, we can see that the median temperatures for "transport" and "non-transport" days are similar (18.6°C for "transport", 18.9°C for "non-transport"). For warm days, above 18-20°C, the "non-transport" temperature distribution actually peaks at a higher temperature than the "transport" distribution. Since temperatures above 20°C are typically associated with ozone exceedances, we also examined the relative percentages of "transport" and "non-transport" days with 850 mb temperatures > 20°C for each summer month (Figure 5-4). There are large variations in the percentages from month to month, but the seasonal averages are close together, with the "non-transport" average being slightly higher. From the temperature distributions alone, one might expect the "non-transport" days to have higher ozone than the "transport" days. Thus it is not likely that the meteorology which leads to "transport" necessarily is conducive to ozone formation. On the average, increases in ozone concentration in Ventura County on "transport" days compared to "non-transport" days can probably be attributed to the transport of ozone or precursors into Ventura County.

To further examine the 850 mb temperature characteristics of "transport" and "non-transport" days, we prepared temperature frequency distributions for both types of days broken down into exceedance (O_3 > 12 pphm) and non-exceedance days for Ventura County. These distributions are shown in Figures 5-5 and 5-6. As expected, the high ozone days for both data sets have higher 850 mb temperatures than the lower ozone days. For the exceedance days, the peak of the distribution is a few degrees higher for "non-transport" days than for "transport" days. This suggests that a greater degree of trapping (lower inversions, shallower mixing) is needed to generate the same ozone concentrations on a "non-transport" day as on a "transport" day.

5.3.3 Ozone Characteristics of "Transport" and "Non-Transport" Days

To examine the pollutant characteristics in Ventura County of "transport" versus "non-transport" days, we calculated the percentages of "transport" and "non-transport" days which were exceedance days at each Ventura County site for each summer month. These percentages are presented in Table 5-3. For the five month period, for all sites but Ojai, a higher percentage of "transport" than "non-transport" days were exceedance days. This is true even though "non-transport" days have higher 850 mb temperatures on the average. Thus transport probably contributes significantly to Ventura County ozone concentrations.

The percentages in Table 5-3 vary greatly from month to month and site to site. A few of these variations are noteworthy. All exceedances at
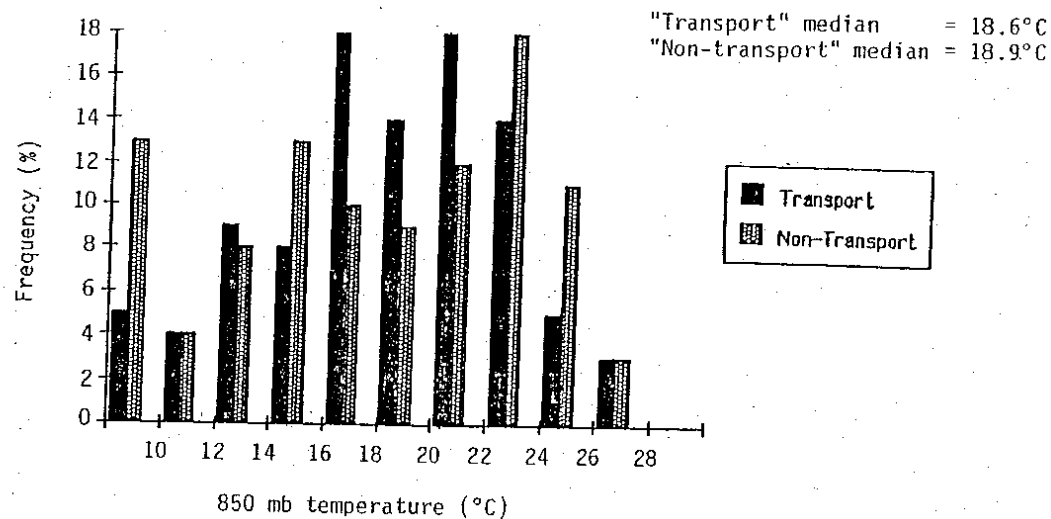
Figure 5-3. Frequency of Occurrence of 0400 PST 850 mb Temperatures at Vandenberg AFB for "Transport" and "Non-transport" Days for June-October, 1980-1983.
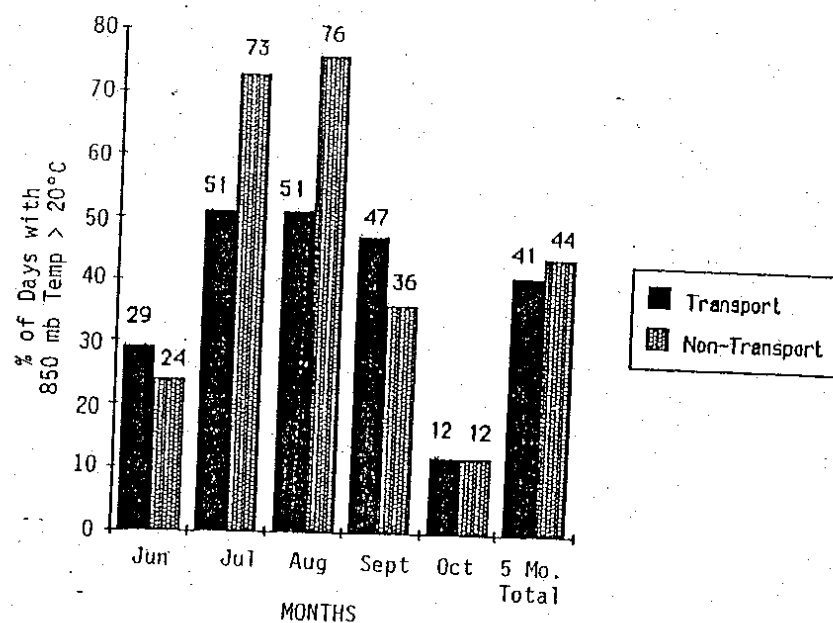
Figure 5-4. Percentages of "Transport" and "Non-transport" Days with Vandenberg AFB 0400 PST 850 mb Temperatures Greater than 20°C for 1980-1983.
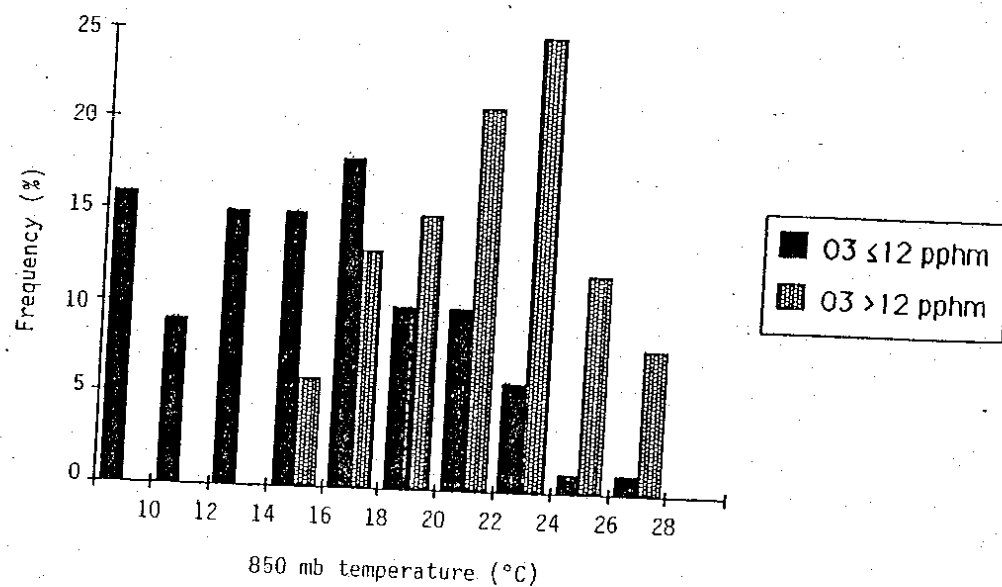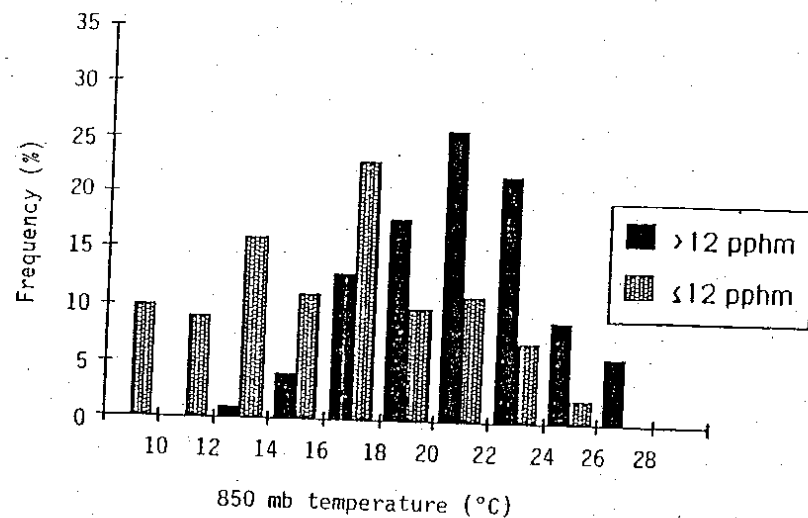
Figure 5-5. Frequencies of Occurrence of 0400 PST 850 mb Temperatures at Vandenberg AFB for Exceedance and Non-exceedance "Transport" Days for June-October, 1980-1983.
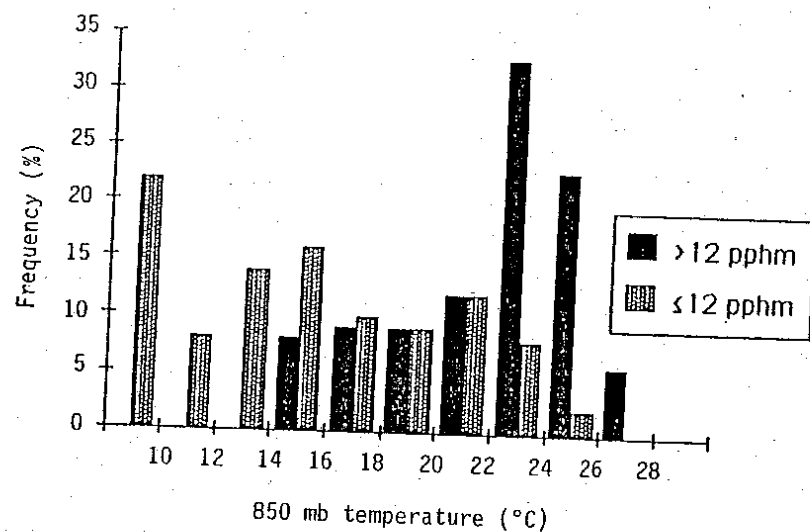
Figure 5-6. Frequencies of Occurrence of 0400 PST 850 mb Temperatures at Vandenberg AFB for Exceedance and Non-exceedance "Non-transport" Days for June-October, 1980-1983.

the coastal valley sites occurred on transport days. This probably implies that the coastal transport and recirculation mechanisms described in Sections 3.2.1 and 3.3.1 are required to accumulate enough ozone to exceed the standard on the coast. These mechanisms are unlikely to occur on "non-transport" days.

From Table 5-3, "transport" is clearly an important phenomenon during September. The percentage of "transport" days with exceedances in the county is about 2 1/2 times that of "non-transport" days, and all of the individual sites show a similar trend. The transport mechanisms described in Section 3 occur most frequently in September. The transport effect seems to be less pronounced in other months and also less strong in the northern part of the county (Simi, Piru) than along Highway 101 in the south (Thousand Oaks).

Table 5-3. Percentages of "Transport" and "Non-Transport" Days for Which Ozone Maxima at Ventura County Stations Exceeded 12 pphm, 1980-1983

Site	% of "transport" (T) or "non-transport" (N)											
	June		July		Aug		Sept		Oct		All 5 Months	
	T	N	T	N	T	N	T	N	T	N	T	N
Ventura Co. Max.	33	42	78	61	56	60	46	19	15	21	48	42
Ventura	2	0	2	0	0	0	5	0	3	0	3	0
El Rio	5	0	2	0	0	0	5	0	3	0	3	0
Ojai	16	12	24	25	10	24	15	8	11	10	15	16
Piru	20	12	39	39	16	21	28	12	14	14	24	21
Rocketdyne	15	35	74	65	60	57	41	22	5	9	43	39
Simi Valley	19	26	43	32	28	27	34	13	16	25	29	25
Thousand Oaks	6	3	10	9	10	5	13	0	17	14	11	7

The percentages of exceedance and non-exceedance days in Ventura County which were transport days are shown in Figure 5-7. The same percentages for each site are compiled in Table 5-4. The percentages of exceedance days which are also transport days clearly reach a maximum in September at all sites. County wide, 84% of all exceedance days in September were transport days while only 60% of non-exceedance days were transport days.

Many of the exceedance days in Table 5-3 are relatively low level exceedances of 13 or 14 pphm. To get an idea of the relationship of transport to higher levels of ozone in Ventura County, we prepared Figure 5-8. Figure 5-8 compares the percentages of "transport" and "non-transport" days which exceeded 12 pphm and 15 pphm. Although there were many fewer days which exceeded 15 pphm, the percentage of "transport" days which exceeded 15
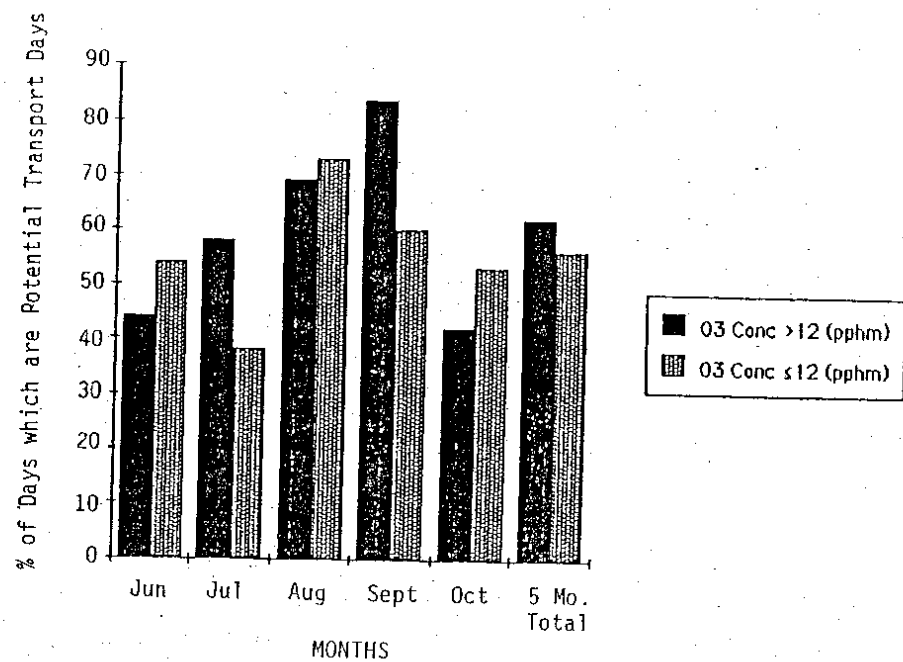
Figure 5-7. Percentages of Potential Transport Days by Month for 1980-1983 for Regional Maximum Ozone Concentrations Greater and Less than 12 pphm.

Table 5-4. Percentages of Exceedance and Non-exceedance Days which were "Transport" Days, 1980-1983.

		JUNE		JULY		AUGUST		SEPTEMBER		OCTOBER		FIVE MONTHS TOTAL	
		% Trans	#Days	% Trans	#Days	% Trans	#Days	% Trans	#Days	% Trans	#Days	% Trans	#Days
El Rio	Days >12	100	2	100	1	0	0	100	3	100	1	100	7
	Days ≤12	49	83	52	85	72	82	69	80	51	65	59	395
	All Days	51	85	52	86	72	82	70	83	52	66	59	402
Ventura	Days >12	100	1	100	1	0	0	100	3	100	1	100	6
	Days ≤12	49	83	52	85	71	86	68	81	49	65	58	400
	All Days	50	84	52	86	71	86	69	84	50	66	59	406
Ojai	Days >12	58	12	50	20	50	12	82	11	50	6	57	61
	Days ≤12	49	74	52	62	74	74	68	74	48	52	59	336
	All Days	50	86	51	82	71	86	69	85	48	58	59	397
Piru	Days >12	62	13	52	33	67	15	84	19	50	8	63	88
	Days ≤12	46	67	52	52	72	68	65	63	49	49	58	299
	All Days	49	80	52	85	71	83	70	82	49	57	59	387
Rocket-Dyne	Days >12	31	16	62	45	68	38	83	23	33	3	63	125
	Days ≤12	58	48	53	19	65	26	66	41	50	42	59	176
	All Days	52	64	59	64	67	64	72	64	49	45	60	301
Simi Valley	Days >12	42	19	61	31	73	22	86	21	44	9	64	102
	Days ≤12	52	67	50	50	72	57	63	56	58	36	59	266
	All Days	50	86	54	81	72	79	69	77	56	45	60	368
Thousand Oaks	Days >12	67	3	50	6	83	6	100	6	57	7	71	28
	Days ≤12	51	61	48	56	70	61	67	58	51	37	58	273
	All Days	52	64	48	62	72	67	70	64	52	44	59	301
Regional Maximum	Days >12	44	32	58	60	69	49	84	32	42	12	62	185
	Days ≤12	54	54	38	26	73	37	60	53	53	55	56	225
	All Days	50	86	52	86	71	86	69	85	51	67	59	410
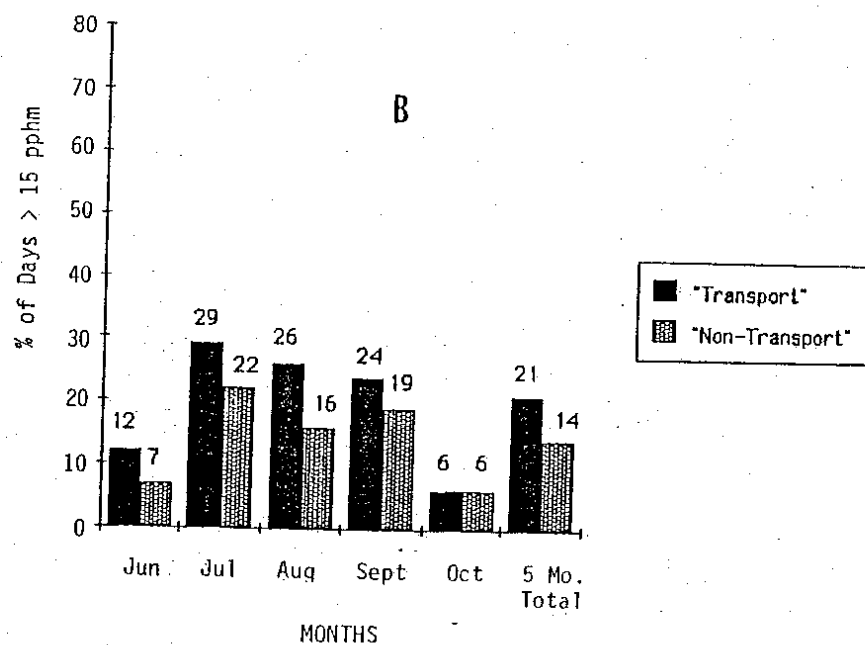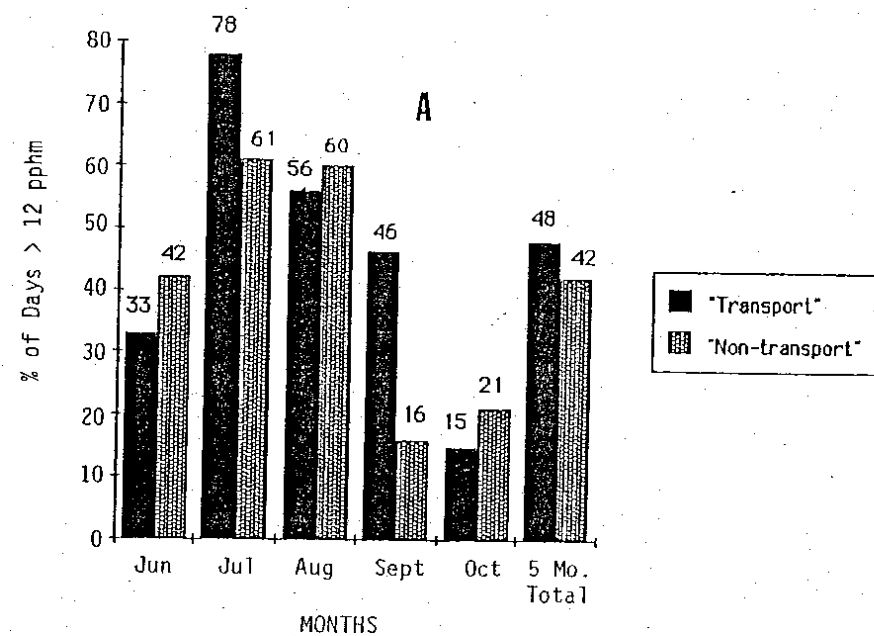
Figure 5-8. Percentages of "Transport" and "Non-transport" Days for which the Ventura County Ozone Maxima Exceeded (A) 12 and (B) 15 pphm, 1980-1983.

pphm was consistently higher than the percentage of "non-transport" days, 50% higher for the 5 month total. An examination of the percentage of those days with ozone maxima > 15 pphm which were "transport" days shows that 68% of the seasonal days above 15 pphm were "transport" days while only 59% of all seasonal days were "transport" days.

5.3.4   Peak Ozone Concentrations on "Transport" Compared to "Non-Transport" Days

Section 5.3.3 showed that transport conditions were conducive to higher ozone concentrations in at least some months at all of the Ventura County monitoring sites in our data base. From the examples in Section 3 (and model results to be presented in Section 7) it is clear that transport from Los Angeles County can be responsible for most of the ozone at selected Ventura county sites under specific circumstances. To get an estimate of the typical contribution of transport to the ozone concentrations at each site for each month, we calculated the 50th and 90th percentile ozone maxima for each site for each of the 5 months for "transport" and "non-transport" days. The results are compiled in Table 5-5 on page 5-14 and are shown for September and for the 5 month total in Figures 5-9 and 5-10. Ventura County and upwind Los Angeles County sites are included. For most of the Ventura County sites and all months but June, the median and 90th percentile ozone maxima on "transport" days were 1-2 pphm higher than on "non-transport" days. For the Los Angeles County sites, the results were generally reversed. One exception was Ojai which didn't seem to see much effect from transport, except in the late summer. Another indicator of the effect of transport is the spatial gradient from east to west seen in Figures 5-9 and 5-10.

To obtain an estimate of the contribution of transport on days with similar stability characteristics, we performed regressions of the Ventura County maximum ozone values against the 850 mb temperature for each month for "transport" days and for "non-transport" days. Using the regression equations obtained, we calculated the predicted ozone concentrations at $20^\circ C$. The results are presented in Table 5-6. The ozone predictions for $20^\circ C$ were slightly above the 12 pphm ozone standard in all cases but one, and the transport predictions were higher than the "non-transport" predictions for all months but June. The "transport" - "non-transport" differences ranged from -1.1 pphm to +1.9 pphm and averaged 0.7 pphm for the 5 month period.

Table 5-6. Predicted Maximum Hourly Ozone Concentration in the Ventura County Network for an 850 mb temperature of $20^\circ C$ (Computed from linear regression equations for "transport" and "non-transport" days using the Vandenberg 0400 PST 850 mb Temperatures.)

	Ozone (pphm)					
	June	July	Aug	Sept	Oct	5 Mos. Combined
"Transport"	12.7	14.3	13.3	13.3	12.6	13.3
"Non-transport"	13.8	12.4	12.4	12.6	11.8	12.6
Difference	-1.1	1.9	0.9	0.7	0.8	0.7

Table 5-5. Daily Maximum and 90th Percentile Ozone Concentrations for Transport and Non-transport Days (1980-1983).

						Statistics for Complete Four Year Data Set					
						Maximum Ozone (pphm) (transport/non-transport)					
	June		July		August		September		October		All Five Months	
Site	50%	90%	50%	90%	50%	90%	50%	90%	50%	90%	50%	90%
El Rio	6/6	9/10	8/6	11/8	6/6	9/8	7/5	11/9	6/6	10/9	7/6	10/9
Ventura	6/7	9/9	7/5	10/8	6/5	8/8	7/5	10/8	6/6	9/9	7/6	10/9
Ojai	9/10	13/13	11/11	15/14.5	10/11	12/14	9/8	13/12	7.5/6	13/12	8/6	13/13
Piru	8/9	15/13	12/12	15/14	10/10.5	14/15	11/8	16/13	5/6	15/13	9/10	15/14
Rocketdyne	10/11	13/15	14/13	19/17	13/13	21/18	10.5/9	18/18	9.5/7	12/11	10/9	18/17
Simi Valley	10/11	13/14	12/11	17/15	11/10	15/14	10/8	15/15	9.5/7	12/12	12/11	15/14
1000 Oaks	7/8	10/10	10.5/9	12.5/12	8.5/9	13/11	9/6	13/12	9.5/8	15/14	11/10	15/15
Burbank	10/12	19/18	14/15	20/23	12/18	21/24	13/12	24/25	8.5/7	15/13	9/8	13/12
Reseda	11/13	17/18	12/14	19/22	12/14	19/23	12/11	20/21	7/7	24/16	12/13	21/22
Lennox	4/5	8/9	5/5	8/8	5/6	8/10	5/4	8/8	7/7	14/21	11/12	19/21
West L.A.	7/8	13/15	8/10	13/14	8/12	13/16	9/8	15/17	5/4	8/7	5/5	8/9
Ven Co. Max	11/11	16/15	14/13	18/17	13/13	20/18	12/9	17/17	9.5/8	15/14	12/11	18/17
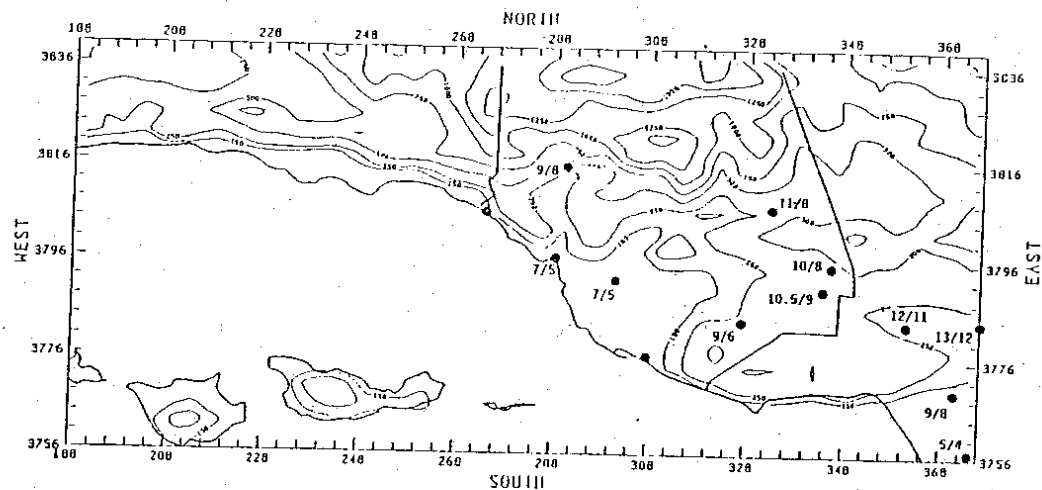
Figure 5-9. Median Daily Ozone Maxima on "Transport" Days and "Non-transport" Days for September, 1980-1983. (Units are pphm; "transport"/ "non-transport".)
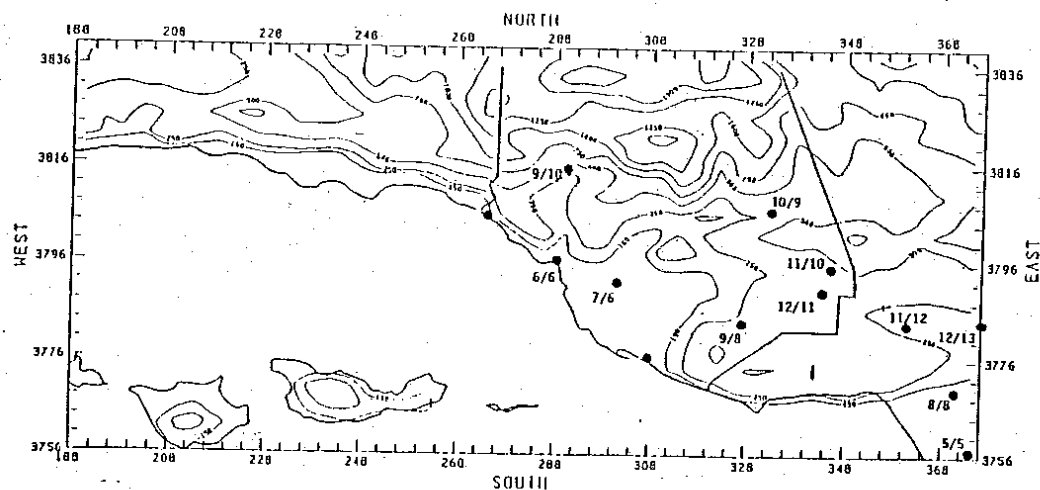
Figure 5-10. Median Daily Ozone Maxima on "Transport" Days and "non-transport" Days for June-October, 1980-1983. (Units are pphm; "transport"/ "non-transport".)

6. REPRESENTATIVENESS OF THE SEPTEMBER FIELD STUDY PERIOD

6.1 INTRODUCTION

To assess the representativeness of the field study period, selected air quality and meteorological parameters for September 1983 were compared with data from 1980-1983. The field study period was assessed from two view points: 1) how representative is September in general compared with the other months in the ozone season, and 2) how representative was the sampling period compared with other September periods. Atmospheric stability representativeness was assessed by examining the Vandenberg AFB 0400 PST 850 mb temperatures. The potential for Los Angeles to Ventura County transport was assessed by comparing the winds aloft measured at Pt. Mugu. Air quality representativeness was assessed by examining the ozone measured at sites which had a sufficient long-term record and were operational during the field study.

The meteorology during the field study exhibited several anomalous features. On six successive days, the 850 mb temperature exceeded the 90th percentile of the long-term September data base. This six-day period accounted for 67% of the September occurrences of temperatures greater than $24^\circ C$ during the four-year period. This suggests greater atmospheric stability than is typical in September. In contrast, the last two weeks of the field study (September 21 to October 6) were characterized by extensive cloudiness, rain showers, and generally low ozone concentrations due to a series of low pressure systems off the Southern California coast. These systems caused an increase in the frequency of Los Angeles to Ventura County transport winds. Nevertheless, the number of ozone exceedances (> 12 pphm) in Ventura County during the field study was comparable to the other September periods examined.

6.2 850 MB TEMPERATURE ASSESSMENT

A strong relationship between the 850 mb temperature at Vandenberg AFB and ozone levels in Ventura County was shown in Section 5. Table 6-1 shows the combined monthly and seasonal frequency distributions of the 0400 PST (12 GMT) 850 mb temperatures at Vandenberg for the 1980 to 1983 oxidant seasons. The data in the table are given in terms of cumulative frequency. The number of occurrences within each $2^\circ C$ temperature range is shown in parentheses. Monthly and seasonal average temperatures are also given in the table.

The maximum average temperature during the oxidant season was experienced in August ($20.6^\circ C$) and the minimum average temperature experienced in October ($13.9^\circ C$). In August, over 60% of the 850 mb temperatures exceeded $20^\circ C$, whereas in October, only 8.9% exceeded $20^\circ C$. In September, the average 850 mb temperature was $18.1^\circ C$, and on 42% of the days the temperature was greater than $20^\circ C$. The September 850 mb temperature distribution exhibited a blend of the August and October temperatures, reflecting the transition in September from summer to fall conditions. This feature is clearly shown in Figures 6-1 and 6-2. Figure 6-1 is a histogram of the 850 mb temperature distributions for August and October. Figure 6-2 includes a histogram of the 850 mb temperature distribution for September. The figures show the most frequent temperature range of the

Table 6-1. Average and Frequency of Occurrence by Month of 0400 PST Vandenberg 850 mb Temperatures

Temp (°C)	Cumulative Frequency (%) (number of occurrences shown in parentheses)					
	June	July	Aug	Sept	Oct	Five Mo. Total
≤ 10.0	11.1(10)	0(0)	3.3(4)	8.5(10)	21.8(27)	8.8(51)
10.1-12.0	18.9(7)	0(0)	4.1(1)	12.7(5)	33.1(14)	13.5(27)
12.1-14.0	30.0(10)	5.6(7)	5.7(2)	22.9(12)	46.0(16)	21.6(47)
14.1-16.0	47.8(16)	16.1(13)	10.6(6)	30.5(9)	62.9(21)	32.8(65)
16.1-18.0	58.9(10)	31.5(19)	19.5(11)	44.1(16)	90.3(34)	48.4(90)
18.1-20.0	74.4(14)	43.5(15)	39.8(25)	57.6(16)	91.1(1)	60.6(71)
20.1-22.0	81.1(6)	63.7(25)	65.9(32)	76.3(22)	91.1(0)	75.3(85)
22.1-24.0	95.6(13)	85.5(27)	82.1(20)	92.4(19)	95.2(5)	89.8(84)
24.1-26.0	100.0(4)	94.4(11)	91.1(11)	99.2(8)	97.6(3)	96.2(37)
26.1-28.0	100.0(0)	100.0(7)	100.0(1)	100.0(1)	100.0(3)	100.0(22)
> 28.0	100.0(0)	100.0(0)	100.0(0)	100.0(0)	100.0(0)	100.0(0)
Average Temp. (°C)	16.7	20.2	20.6	18.1	13.9	18.0
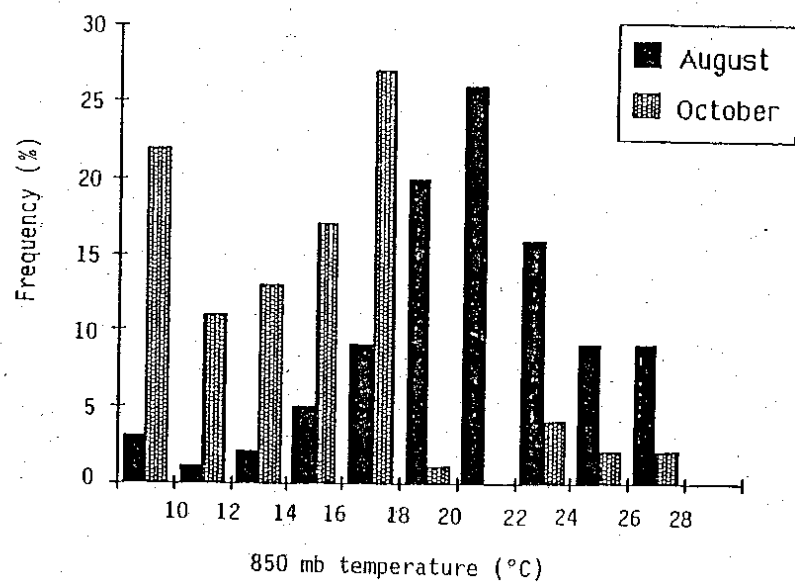
Figure 6-1.   Frequency of Occurrence of Vandenberg AFB 0400 PST
              850 mb Temperatures During August and October, 1980-1983.
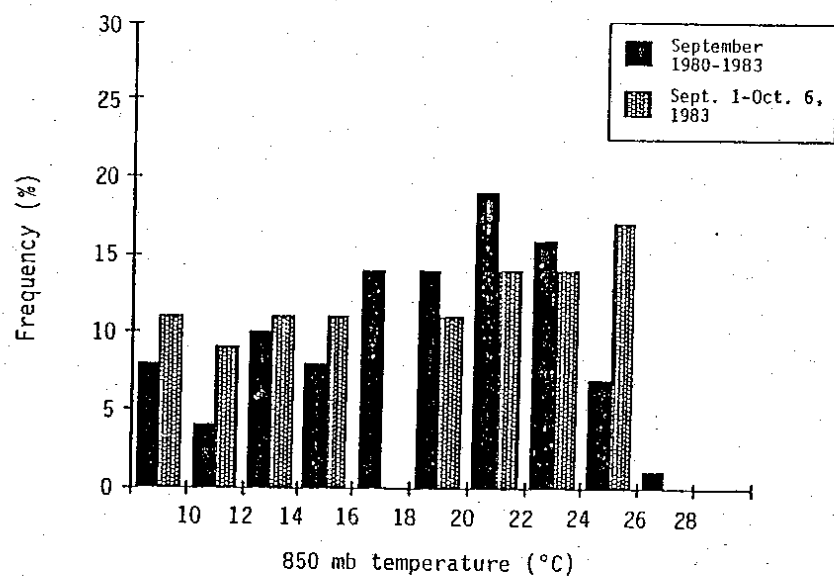
Figure 6-2.   Frequency of Occurrence of Vandenberg AFB 0400 PST
              850 mb Temperatures During September 1980-1983 and
              During the VCOT Study Period.

Vandenberg 850 mb temperatures for both August and September to be 20^0-22^0. On the other hand, like October, the September data also show a large number of occurrences of temperatures less than 18^0C. From Table 6-1, it is also seen that the September 850 mb temperatures are distributed remarkably similarly to the seasonal (June through October) data. The seasonal average 850 mb temperature is 18^0C, and 39% of the seasonal temperatures exceed 20^0C.

The frequency distribution of Vandenberg 0400 PST 850 mb temperatures for the VCOT sampling period is compared in Table 6-2 to that for the Septembers of 1980-1983. The data in the table are shown as cumulative frequencies. The numbers of occurrences are shown in parentheses. In Figure 6-2 the same data are presented in histogram form. A notable feature of the data is the distribution above 24^0C or the 92nd percentile of the September 1980-1983 data. Sixty-seven percent of those occurrences were in 1983. These extremes occurred in one six-day period from September 11 to 16. The long-term and 1983 data show some notable similarities as well. For both temperature distributions, there is a tendency for the data to fall into two groups; one group consisting of the warm summer type conditions and a second consisting of the cooler fall type conditions. The 1983 data in Figure 6-2 most clearly illustrate this feature. Temperatures ranged from 18.1^0C to 24^0C for one group of days and ranged from 16^0C down in a second group of days. There were no occurrences of 850 mb temperatures from 16.1^0C to 18^0C. From Table 6-2 it can be seen that, although temperature extremes were experienced in 1983, the two data sets had similar percentages of occurrences less than and above the 20^0C level. In Section 5, 20^0C was used as an indicator to distinguish days which were likely to have high ozone values.

The daily 0400 PST Vandenberg 850 mb temperatures during the field program are plotted in Figure 1-3. The September 1980-1983 average temperature is shown as a dashed line. Features of the sampling period discussed above are illustrated in the figure. The September 1-20 period was characterized by warmer than average temperatures aloft. After September 20, the 850 mb temperatures cooled and remained below average for the remainder of the sampling period. Temperatures above the long-term September 92nd percentile (24^0C) were experienced from September 11 to 16. (Note that the ozone standard was exceeded on each of those days.)

6.3   TRANSPORT ASSESSMENT

It was shown in Section 4 that all of the exceedance days in Ventura County during the field program occurred when the flow aloft was directed from Los Angeles County. Specifically, the 1000 PST (18 GMT) 3000 ft-msl winds at Pt. Mugu proved to be a good indicator of the potential for intercounty transport when the direction was between 45^0 and 180^0. On this basis, each day during the oxidant season (June-October) from 1980 to 1983 when Pt. Mugu data were available was classified as either as a "transport" or "non-transport" day. The percentage of days in each month that "transport" winds occurred are shown in Table 6-3. During the five month oxidant season, "transport" winds occurred on 59% of the days. August (75%) and September (69%) experienced the highest frequencies of occurrence. "Transport" winds occurred on about half the days during June, July, and October.

Table 6-2. Average and Frequency of Occurrence of 0400 PST Vandenberg 850 mb
Temperatures for September (1980-1983) and for VCOT Sampling Period

Temp (°C)	Cumulative Frequency (%) (number of occurrences shown in parentheses)	
	September 1980-1983	1 September 1983 to 6 October 1983
<10	8.5(10)	11.4(4)
<10.1-12.0	12.7(5)	20.0(3)
<12.1-14.0	22.9(12)	31.4(4)
<14.1-16.0	30.5(9)	42.9(4)
<16.1-18.0	44.1(16)	42.9(0)
<18.1-20.0	57.6(16)	54.3(4)
<20.1-22.0	76.3(22)	68.6(5)
<22.1-24.0	92.4(19)	82.9(5)
<24.1-26.0	99.2(8)	100.0(6)
<26.1-28.0	100.0(1)	100.0(0)
>28	100.0(0)	100.0(0)
Average Temperature (°C)	18.1	17.7

Table 6-3. Frequency of Occurrence (%) of Los Angeles to Ventura County
Transport Winds

Jun.	Jul.	Aug.	Sept.	Oct.	Combined	Sept. 1983
50	52	71	69	51	59	77

(Based on 1980-1983 Pt. Mugu 1000 PST winds when available.)

It should be noted, that transport from Los Angeles County may or may not cause poor air quality in Ventura County. Wind direction only indicates the probable source of the air aloft. Other factors which take into account the air mass history and dispersion characteristics determine the air quality impact. In fact, in this data base only 48% of the "transport" days were exceedance days (O_3 > 12 pphm).

From Table 6-3 it is seen that September 1983 had a greater than usual occurrence of transport days (77%). This feature was due in part to the extended period of southerly flow aloft experienced after September 20th as a result of an unusual succession of closed low pressure systems offshore of the Southern California coast. This period was characterized by generally low ozone levels and no exceedances in Ventura County.

6.4   OZONE ASSESSMENT

The number of days on which the Federal ozone standard (12 pphm) was exceeded during 1978-1983 is shown in Table 6-4. These data are extracted from the California Air Quality Summaries (CARB, 1978-1983). The data are shown as the average number of exceedances for each month of the oxidant season (June through October) at four locations in Ventura County, one (Goleta) in Santa Barbara County, and four in Los Angeles County. Lennox and West Los Angeles are representative of Los Angeles County upwind ozone levels when the trajectory from Los Angeles County to Ventura County is offshore. Burbank and Reseda, in the San Fernando Valley are representative upwind sites when the transport trajectory to Ventura County is inland. The data in the table are organized such that the coastal (or coastal plain) sites, the Ventura County inland valley sites, and the Los Angeles County inland sites are grouped together.

The inland sites experienced the maximum number of exceedances in July and the fewest in October. An equal number of exceedances were experienced at the inland sites in August as in September. There was about a 50% increase in July exceedances over exceedances in August or September at the inland locations. The ratio of the July to September number of exceedances was 1.66, 1.50, and 1.62 for Simi, Piru, and Ojai, respectively.

Table 6-4. Average Number of Occurrences per Month of Daily Ozone Concentrations > 12 pphm During July-October from 1978 through 1983

Name	Site Location	Jun.	Jul.	Aug.	Sept.	Oct.
Goleta	Santa Barbara Co.-Coastal	.3	.3	.5	1.3	0
El Rio	Ventura Co.-Coastal	.5	.2	.3	2.3	.8
Lennox	Los Angeles Co.-Coastal	.6*	.3	.5	1.5	.2
Ojai	Ventura Co.-Inland Valley	3.4*	6.8*	4.8*	4.2	3.3
Piru	" "	4.2*	10.8*	6.6*	7.2*	2.6*
Simi	" "	7.5	13.3	10.7	8.0	5.2
West L.A.	L.A. Co.-Inland	4.4*	5.8*	6.0*	8.3	3.7
Reseda	L.A. -Inland Valley	14.7	18.5	15.3	15.8	6.8
Burbank	" "	13.7	21.5	19.8	17.8	8.7

* Based on only 5 years of records.

The coastal locations (El Rio, Goleta, and Lennox) exhibited an entirely different pattern. These sites experienced very few ozone exceedances, but those that did occur were most likely to occur in September. The number of exceedances in September was greater than or equal to the number experienced during the remainder of the smog season. The coastal exceedances most frequently occurred during post-Santa Ana conditions. During Santa Ana winds, Los Angeles Basin air is transported offshore. When the prevailing westerly onshore flow is reestablished, primarily the coastal sites are impacted.

The above features also show up in the monthly average of the daily ozone maxima given in Table 6-5. These data were extracted from the 1980-1983 data base. The additional Ventura County sites at Rocketdyne and Thousand Oaks are included in this table. Portions of our Ventura (city) data were suspected to be in error and are not included in the table. Note that even on the average, El Rio on the Ventura County coastal plain experienced peak ozone levels in September. The averages at the inland monitoring sites peaked in either July or August.

Table 6-5. Monthly Average of the Daily Ozone Maxima (pphm) from 1980-1983

Site	June	July	Aug.	Sept.	Oct.
El Rio	6.7	7.0	6.3	7.2	6.1
Thousand Oaks	8.0	9.6	8.8	8.6	8.1
Rocketdyne	10.7	13.5	13.7	11.4	7.7
Simi Valley	10.5	11.6	10.7	10.0	8.2
Piru	9.2	11.1	10.6	9.9	6.9
Ujai	9.3	10.7	10.3	9.2	7.3
Burbank	12.1	15.3	14.6	13.5	8.8
Reseda	12.1	14.1	13.4	12.2	8.5
Lennox	5.6	5.6	5.8	5.5	5.2
West L.A.	8.9	9.8	9.8	9.6	7.7

The ozone data suggest that the causes of high oxidant levels in Ventura County are seasonally dependent and that September, more than any other month, experiences a variety of the conditions which result in high ozone levels at both coastal and inland locations in Ventura County.

The September data in Table 6-4 are presented in more detail in Table 6-6. The latter table shows the number of exceedances by year and the average number of monthly exceedances for the six-year period (1978-1983). The 1983 ozone experience closely resembles the longer-term average and is well within the year-to-year variability shown in the table. Exceedances occurred on the Ventura coastal plain on three consecutive days during the sampling period (September 11-13). El Rio measured exceedances on September 11 and 13 and Ventura (not shown in the table) on September 12 and 13. Goleta, in Santa Barbara County, had exceedances on three days in 1983; the highest frequency during the 6 year period. September 11 and 12 were operational sampling days on which detailed air quality and meteorological data were collected and analyzed.

Table 6-6. Number of Occurrences of Daily Maximum Ozone Concentration
> 12 pphm For September 1978-1983

Location	1978	1979	1980	1981	1982	1983	1978-1983 Average
Goleta	1	2	0	1	1	3	1.3
El Rio	3	6	0	3	0	2	2.3
Lennox	4	2	0	0	1	2	1.5
Ojai	2	8	6	3	3	3	4.2
Piru	-	11	9	9	1	6	7.2
Simi	8	14	4	10	2	10	8.0
West L.A.	9	13	6	5	7	10	8.3
Reseda	9	19	20	25	8	14	15.8
Burbank	15	23	19	20	11	19	17.8

7. MODEL SIMULATIONS OF TRANSPORT AND LOCAL CONTRIBUTIONS TO SURFACE OZONE CONCENTRATIONS FOR SELECTED TRAJECTORIES.

Some exploratory photochemical modeling was performed by ERT to complement the data analysis described in the previous sections. Like data analysis, photochemical modeling is a tool capable of improving the understanding of factors contributing to high ozone concentrations. The primary objective of the modeling was to assess the relative contributions of local and transported pollutants to the daily maximum ozone concentrations measured at a few sites in Ventura County. The transport component is a combination of transported ozone and ozone precursors, NMHC and NO_x. The local component is the ozone formed from Ventura County NMHC and NO_x emissions. The nature of this analysis was exploratory, and the scope was limited to examining a few days with evidence of ozone transport from Los Angeles to Ventura County.

From the outset, it was recognized that any quantification of the local and transport components would apply only to the days considered (not in general) and be approximate. The sparseness of the aerometric data available for use in modeling and the uncertainties in the model limit the reliability of estimates derived from them. For example, very little upper air wind data and no speciated NMHC data are available for the September-October 1983 study period. Also, a trajectory model was selected for use in the study because the available data were viewed as insufficient to justify use of a grid model.

The model selected is the PLMSTAR model (Godden, et al. 1985) which employs the moving "wall of cells" trajectory concept to simulate transport, dispersion, and chemical reactions. The model inputs include the available wind, temperature sounding, land cover, emissions, and air quality data. The model assumes an air parcel (approximately 20 km wide by 1 km high and divided into 25-50 cells) is advected as a continuous air mass along a trajectory for periods of up to 12 hours. While this concept may be valid for certain well-developed flow situations, it is not generally valid because the atmospheric boundary layer has significant vertical wind shear. That is, air in different layers above the surface moves at different speeds and in different directions. Trajectory models cannot explicitly simulate wind shear effects and, therefore, cannot simulate complex flow situations well. Flow fields in regions like Ventura County, which have significant terrain features and land-sea surface temperature differences, are expected to be complex, especially under meteorological conditions conducive to high ozone levels. These factors are important qualifiers on the results presented in this section. The layered nature of the flow in the study region was accounted for as well as possible, within the constraints of the trajectory modeling framework, by distinguishing surface and upper air trajectories on certain days. The surface and upper air trajectories were simulated separately until the mixing depth became sufficiently deep to entrain the upper layers. From that point on, a single air mass trajectory was simulated.

7.1 TRAJECTORIES AND METEOROLOGICAL CONDITIONS

Several criteria were employed in selecting days and trajectories for photochemical modeling. The principal criteria were high ozone in Ventura County and evidence of significant ozone transport from Los Angeles County to

7-1

Ventura County. Numerous days in mid-September satisfied these criteria, so
a secondary criteria of trajectory reliability was employed to select three
days and a total of five trajectories for modeling. The trajectories are shown
in Figures 7-1 through 7-5.

Trajectory #1 for September 11, 1983 involves the most complex flow
of the trajectories selected. During the morning, light westerly winds in the
Santa Barbara Channel transported presumably clean air toward Ventura County
at the same time as easterly winds transported ozone-laden air aloft over
water from the Los Angeles Basin. Evidence for the overwater transport of
ozone includes easterly winds at Malibu up to 1300 hours PST and aircraft
ozone observations south of Pt. Mugu showing 100-200 ppb above the surface
after 1000 hours PST. Convergence and complex mixing of the easterly and
westerly flows occurred offshore in midday as the sea breeze strengthened and
entrained the easterly flow from aloft. The sea breeze brought
pollutant-laden air onshore in the afternoon hours. The trajectory shown in
Figure 7-1 is oriented to bring the air over the El Rio monitor at 1530 PST
where 140 ppb of ozone was observed, the maximum in the Ventura County
network on September 11. In order to model this split trajectory case, the
lower and upper layers of the air parcel were used to characterize the
westerly and easterly flows, respectively. These layers were allowed to mix
during the hour before the trajectory reached the shoreline.

The highest ozone concentrations during September 1983 in Ventura
County were observed on the 12th. Trajectories #2 and #3 were selected for
simulation on this day to illustrate the overwater and overland transport
mechanisms, respectively. Trajectory #2 began offshore, south of Pt. Dume with
east-southeasterly flow. Based on the offshore and coastal wind data, the flow
became more southerly during the mid-morning. Trajectory #2 is oriented to
bring the air onshore in Ventura at 1230 PST where 150 ppb of ozone was
observed for the 1200-1300 PST hour, which was the highest hourly ozone
concentration observed along the coast on this day. The trajectory also passes
over the Ojai station around 1340 PST where 130 ppb of ozone was observed.
Vertical wind shear along this trajectory was probably much less than along
the September 11th trajectory. The available data suggest the flow aloft had
roughly the same direction as the surface flow into western Ventura County;
however, the wind speeds aloft were probably lower than at the surface.

Trajectory #3 begins over land, near Pomona in a light
east-southeasterly flow. Previous day ozone concentrations at stations east
of Los Angeles were very high, up to 370 ppb (at Azusa), so the southeasterly
flow aloft is expected to have high ozone concentrations above the surface
layer. Wind speeds in the southeasterly flow increased to approximately 5
m/s by midday, carrying the air past Los Angeles and into the San Fernando
Valley, where 190 and 280 ppb of ozone were observed at the Reseda and
Rocketdyne stations at 1200 PST. Subsequent transport carried the
pollutant-laden air to the Simi Valley monitor, where 230 ppb of ozone was
observed at 1300 PST. Trajectory #3 is oriented to pass the Simi Valley
monitor at 1330 PST and then turn sharply to the east, reflecting the strong
sea breeze flow evident in the afternoon. We are fairly confident in this
trajectory's representation of the flow between 1000 and 1300 PST; however,
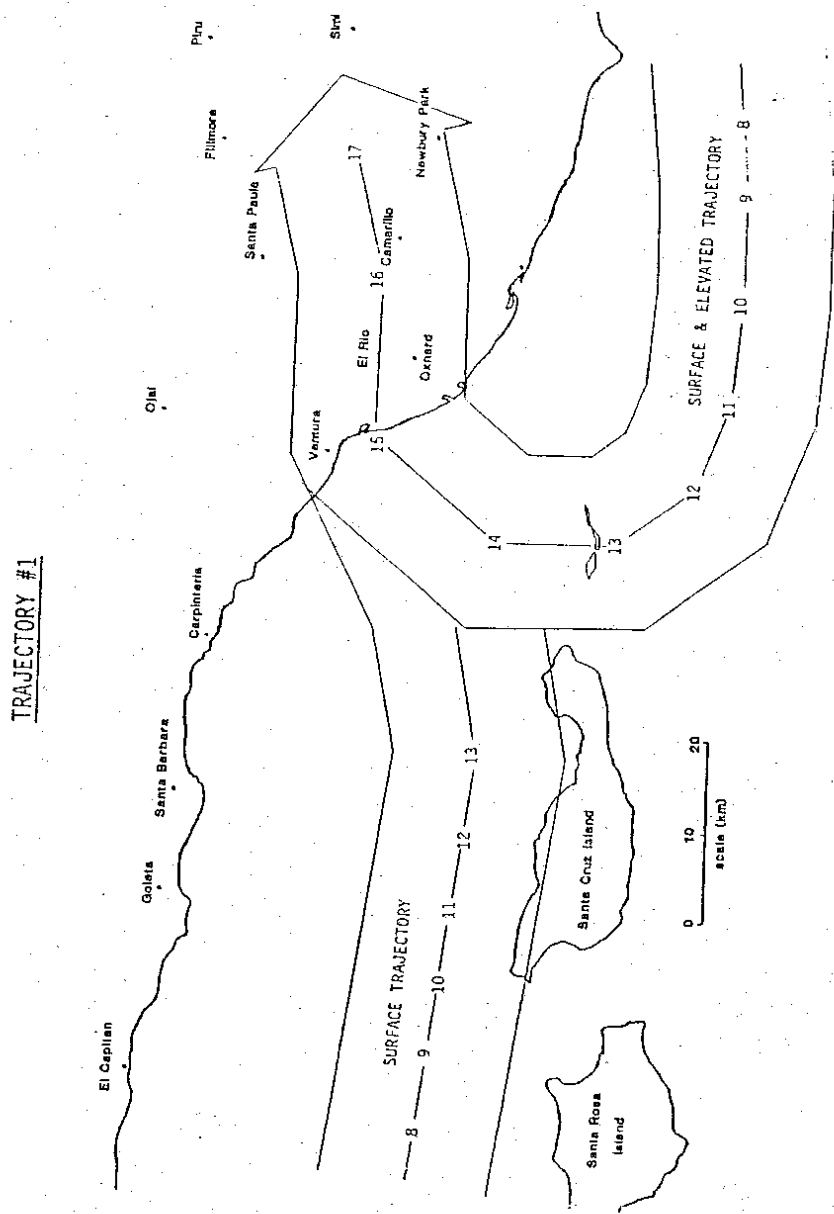
TRAJECTORY #1

Figure 7-1. Surface and Elevated Trajectories Passing El Rio at 1530 PST on September 11, 1983. (Hours shown along trajectories are PST.)
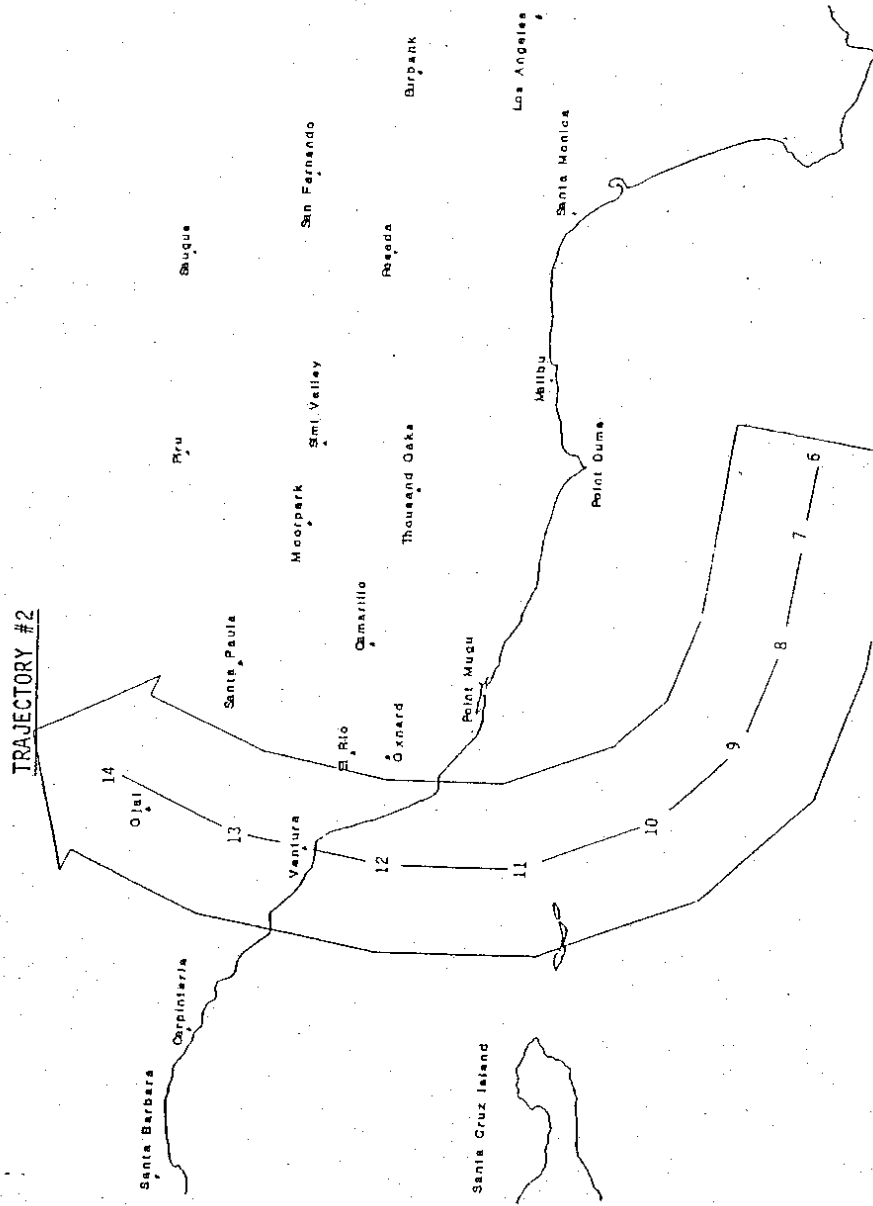
Figure 7-2. Trajectory Passing Ventura at 1230 PST on September 12, 1983. (Hours shown along trajectory are PST.)
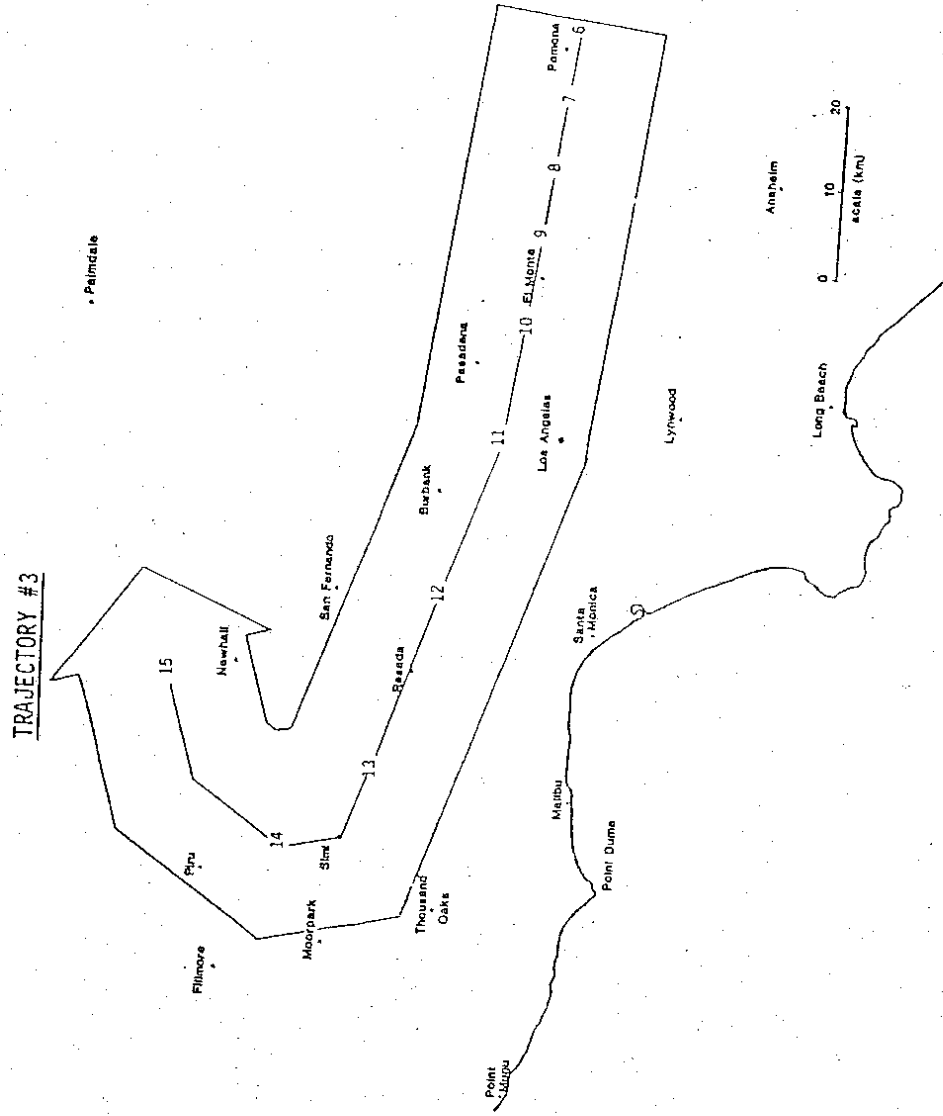
Figure 7-3. Trajectory Passing Simi Valley at 1330 PST on September 12, 1983.
(Hours shown along trajectory are PST.)
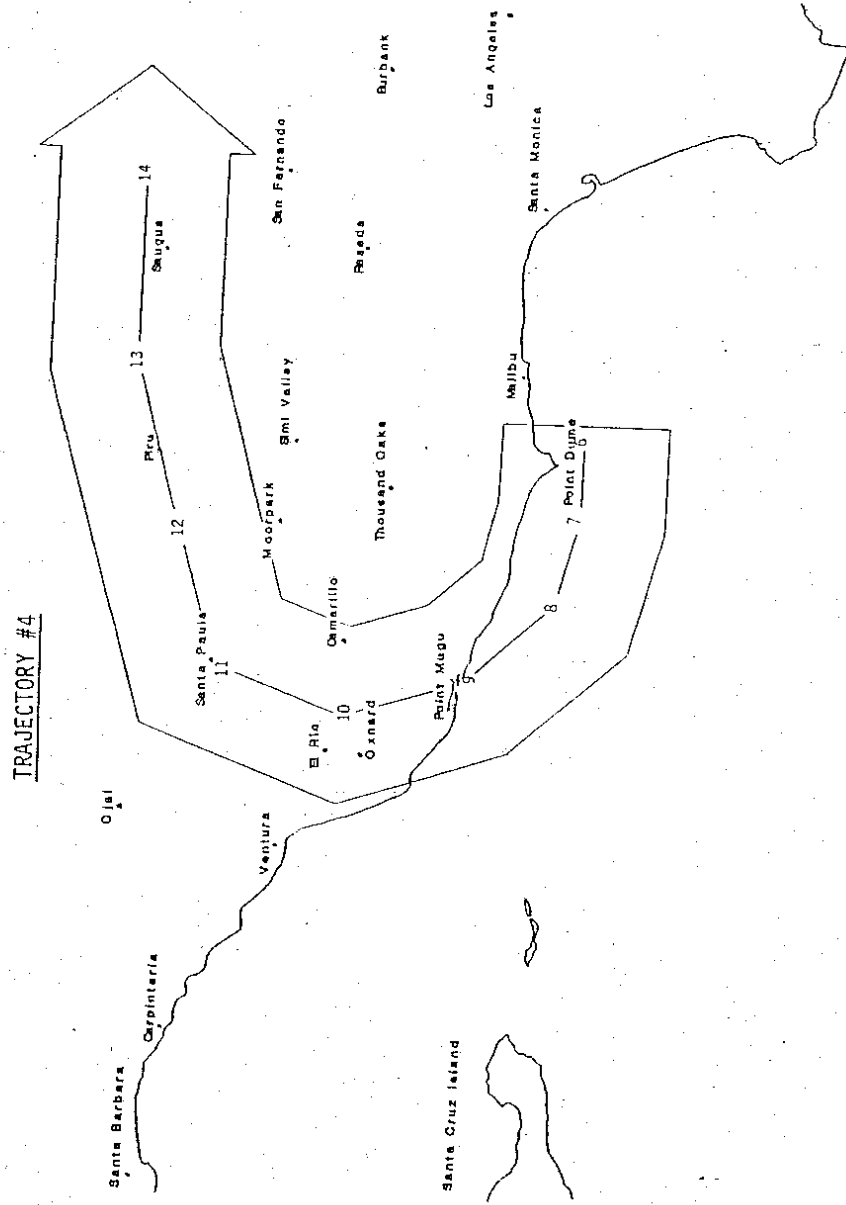
TRAJECTORY #4

Figure 7-4. Trajectory Passing Piru at 1230 PST on September 14, 1983.
(Hours shown along trajectory are PST.)

TRAJECTORY #5

Santa Barbara

Carpinteria

14

Ojai

13

Ventura

12

El Rio

Oxnard

11

Santa Paula

Camarillo

Point Mugu

Moorpark

Simi Valley

Thousand Oaks

Pru

Saugus

San Fernando

Pacoima

Burbank

Los Angeles

Santa Monica

Malibu

Point Duma

Santa Cruz Island

10

9

8

7

6
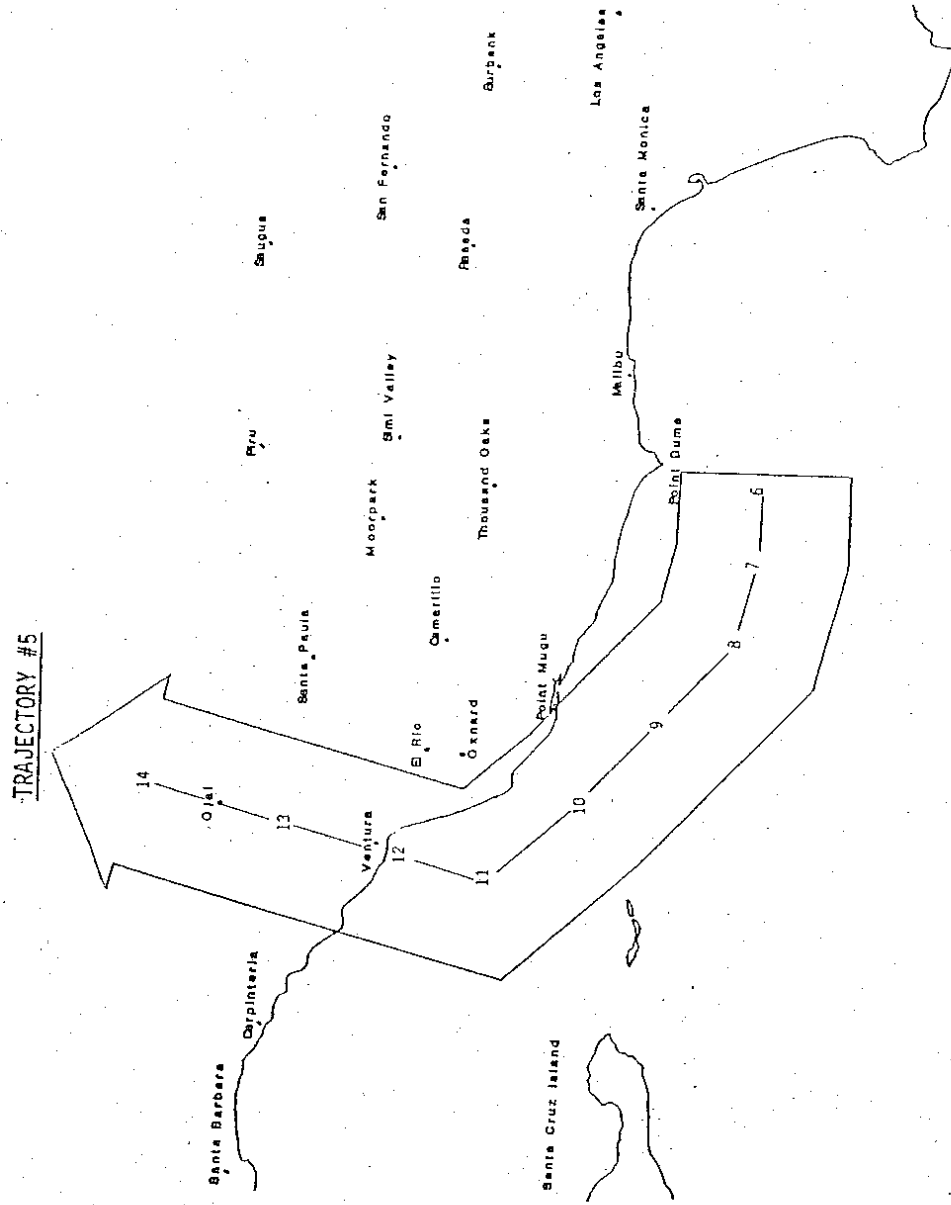
Figure 7-5. Trajectory Passing Ojai at 1330 PST on September 14, 1983.
(Hours shown along trajectory are PST.)

between 1300 and 1400 PST (i.e., when the maximum ozone was observed), there was convergence of the sea breeze flow and flow from the San Fernando Valley, which reduces our confidence in the flow field used for the modeling after 1300 PST. Other ozone measurements along the trajectory reflect the expected trends for the sharp trajectory turn. Piru, on the outer edge of the trajectory path, observed 140 ppb of ozone at 1400 PST, presumably due to the sea breeze flow. Newhall, on the inside edge, recorded 240 ppb, presumably from much of the same air which influenced the Simi Valley monitor. It is likely, however, that the flow aloft persisted in the southeasterly direction, rather than turning inland like the surface flow. Thus, there probably was significant vertical wind shear after 1300 on this trajectory.

Trajectories #4 and #5 for September 14 illustrate cases with ozone transport over water in early morning southeast flows followed by late morning and midday sea breeze flows. Both trajectories begin south of Pt. Dume. Trajectory #4, initially closer to the coastline, traverses over Pt. Mugu (0900 PST) and Santa Paula (1100 PST) on its path to reach the Piru monitor at 1230 PST, where 140 ppb of ozone was observed. Trajectory #5 remains offshore longer than #4 and traverses Ventura at 1200 PST on its path to reach the Ojai monitor at 1330 PST, where 150 ppb of ozone was observed. Coastal fog was present (approx. 200 m thick) on this morning, so the early morning hours of both trajectories were simulated with reduced solar radiation. The winds aloft were most likely southerly or southeasterly for most of the day. Thus, vertical wind shear was possible above the mountain ridges during the later stages of trajectory #4.

Tables 7-1 through 7-5 list the hourly meteorological parameters estimated for modeling the five trajectories. Wind speed, wind direction, 50-m air temperature, atmospheric stability, and mixing height are shown. Fairly stable conditions and relatively low temperatures were used offshore. Unstable conditions and warmer temperatures were employed onshore. The mixing heights were estimated from vertical temperature profiles. All of the mixing heights were low (<600 m above ground level) during this period. The overwater mixing heights were generally 100 to 250 meters agl. The afternoon mixing heights over land were 250 to 550 meters agl.

7.2   AIR QUALITY INPUTS

Initial concentrations of O_3, NO_x, and eight classes of hydrocarbons at the time and position of the trajectory start point are required for the modeling. Estimates are needed for five vertical layers up to approximately 500 m agl. Table 7-6 shows the concentrations employed for the simulations. The "surface" values were used for the lowest two layers of the air parcel (0-50 m and 50-100 m). The "aloft" values were used for the layers above 100 m. The ozone and NO_x (above 5 ppb) were roughly extrapolated from the available measurements.

Speciated NMHC measurements were not available onshore or offshore for the study period. An analysis of NMHC data collected during September 1980 in Santa Barbara and Ventura Counties was performed to derive estimates of the NMHC composition and ranges of concentrations. This analysis is

TABLE 7-1

METEOROLOGICAL CONDITIONS ALONG TRAJECTORY #1
SEPTEMBER 11, 1983

Hour (PST)	Wind Speed (m/s)	Wind Direction (Deg)	50-m Temperature (°C)	Stability (1-6)	Mixing Height (m agl)
6	3	300	18.1	4.1	100
7	3	300	18.2	4.1	100
8	3	300	18.5	4.1	100
9	2	300	19.0	4.2	130
10	2	290	19.6	4.4	150
11	3	280	20.1	4.5	170
12	4	280	20.8	4.7	185
13	6	255	20.9	4.9	200
14	5	240	21.4	5.0	200
15	5	270	26.6	2.9	250
16	5	255	28.7	3.6	270
17	4	275	28.4	4.0	380

TABLE 7-2

METEOROLOGICAL CONDITIONS ALONG TRAJECTORY #2
SEPTEMBER 12, 1983

Hour (PST)	Wind Speed (m/s)	Wind Direction (Deg)	50-m Temperature (°C)	Stability (1-6)	Mixing Height (m agl)
6	3	110	21.0	5.0	100
7	3	110	21.7	5.0	100
8	3	120	22.3	5.0	125
9	2.5	140	23.9	5.0	150
10	4.5	160	24.7	5.0	175
11	4.5	180	25.2	5.0	200
12	5.0	195	25.3	5.0	200
13	4.0	195	28.1	3.0	270
14	3.0	205	29.7	2.1	210
15	3.0	205	29.7	2.1	210

TABLE 7-3

METEOROLOGICAL CONDITIONS ALONG TRAJECTORY #3
SEPTEMBER 12, 1983

Hour (PST)	Wind Speed (m/s)	Wind Direction (Deg)	50-m Temperature (°C)	Stability (1-6)	Mixing Height (m agl)
6	2.0	100	19.5	3.1	100
7	2.5	100	23.2	2.3	120
8	2.0	100	26.1	2.3	140
9	3.5	100	27.3	2.1	290
10	4.0	100	28.9	2.6	350
11	4.5	115	30.7	2.7	420
12	5.0	115	31.2	2.8	440
13	5.5	115	31.5	2.9	330
13.5	4.0	165	32.6	3.0	210
14	6.0	220	31.3	2.7	320
14.5	6.0	250	30.5	2.8	320
15.0	6.0	250	29.3	2.9	270

TABLE 7-4

METEOROLOGICAL CONDITIONS ALONG TRAJECTORY #4
SEPTEMBER 14, 1983

Hour (PST)	Wind Speed (m/s)	Wind Direction (Deg)	50-m Temperature (°C)	Stability (1-6)	Mixing Height (m agl)
6	3	90	20.0	4.0	200
7	3	110	20.8	5.0	225
8	4	130	21.9	5.0	250
9	4	170	21.9	4.4	270
10	4	200	22.3	3.8	300
11	4	255	25.7	3.4	390
12	5	255	29.6	3.8	540
13	5	270	29.2	3.6	470
14	4	270	27.5	2.4	400
15	4	270	25.9	2.4	350

TABLE 7-5

METEOROLOGICAL CONDITIONS ALONG TRAJECTORY #5
SEPTEMBER 14, 1983

Hour (PST)	Wind Speed (m/s)	Wind Direction (Deg)	50-m Temperature (°C)	Stability (1-6)	Mixing Height (m agl)
6	3	90	20.0	4.0	200
7	3	110	20.8	5.0	225
8	4	130	21.9	5.0	250
9	4	130	22.6	5.0	300
10	3	140	21.8	5.0	250
11	3	200	21.2	5.0	225
12	4	200	22.2	4.7	260
13	4	200	26.8	3.0	400
14	4	200	28.0	2.2	390
15	4	210	28.0	2.2	290

TABLE 7-6

INITIAL CONCENTRATIONS (ppb)

Species	Trajectory #1		Trajectory #2		Trajectory #3		Trajectory #4		Trajectory #5	
	Surface	Aloft	Surface	Aloft	Surface	Aloft	Surface	Aloft	Surface	Aloft
O_3	60	150	50	70	50	150	80	120	80	120
NO_x	5	10	20	5	25	5	10	5	10	5
NO	1	2	4	1	12.5	1	2	1	2	1
NO_2	4	8	16	4	12.5	5	8	5	8	4
NMHC[1]	300	300	400	300	600	400	300	300	300	300
>C3 Alkanes	180	210	240	210	342	280	180	210	180	210
Ethylene	39	15	24	15	42	20	18	15	18	15
Propylene	3	0	4	0	12	0	3	0	3	0
Butenes	3	12	4	0	12	0	3	0	3	0
Toluene	12	3	20	12	42	16	15	12	15	12
Xylene	12	9	32	3	60	4	24	3	24	3
Formaldehyde	9	9	12	9	18	12	9	9	9	9
>C2 Carbonyls	6	6	8	6	12	8	6	6	6	6
$\overline{NRMC}$	51	60	60	60	90	80	45	60	45	60

[1] Hydrocarbon concentrations in ppbC.
[2] Aldehydes excluded from NMHC total.
[3] Surface = 0 to 100 m; Aloft = 100-400 or 500 m.

7-12

described in Appendix C. The 1980 onshore morning data showed 600 to 900 ppbC NMHC on the average in urban locations and approximately 200-250 ppbC on the average at more remote sites like Pt. Conception and Gaviota. It was assumed that the hydrocarbons offshore would be lower in concentration than those observed onshore in 1980, and values of 300 to 400 ppbC were selected. For the Pomona start location, we assumed 600 ppbC in the surface layer. The surface layer's initial NMHC composition was estimated from the 1980 Port Hueneme data for trajectories #2, #4 and #5, from the 1980 Pt. Conception data for trajectory #1, and from the 1980 Simi Valley data for trajectory #3. The NMHC composition aloft was assumed to have lower ethylene and xylenes fractions and higher alkane fractions than the Port Hueneme data. Propylene and butene fractions aloft were set to zero because their lifetimes are fairly short in the presence of significant ozone concentrations.

The initial concentration profiles, especially those for hydrocarbon species, are uncertain. Some diagnostic adjustments to the initial concentration profiles were made to improve model performance. However, it was recognized that numerous combinations of HC, NO_x and O_3 profiles can generate similar maximum ozone predictions and that insufficient data were available to determine which combination was correct. For example, similar onshore ozone predictions can be obtained using high initial HC and NO_x with low O_3 aloft and using low initial HC and NO_x with high O_3 aloft. So instead of searching for the best combination of initial values, sensitivity analysis was performed for one of the trajectories to illustrate the importance of these inputs.

7.3.   EMISSIONS INPUT

Emission inventories compiled by CARB for 1979 were employed for the modeling. The Ventura and Los Angeles County area source inventories were spatially resolved on 2 x 2 km and 5 x 5 km grids, respectively. The area source HC and NO_x inventories include stationary sources with stacks less than 30 m and the mobile sources. Point sources with significant stack heights were inventoried separately by exact location rather than by grid square. The use of 1979 emissions estimates, rather than 1983, may have overestimated the emission rates. However, the difference between 1979 and 1983 is probably within the uncertainty of the estimates. 1983 data for the power plants along the Ventura County coastline and emissions from three OCS platforms (Grace, Gilda, and Gina) were included as well.

The air parcel geometry used for these trajectories employed five 4-km wide columns (20 km total width). Emission rate schedules for each column of the air parcel were generated. The total emissions entrained along the trajectories from mobile, stationary areas, and major point sources are listed in Table 7-7. These data show that trajectory #3 entrains more than a factor of 10 more HC and NO_x than the other trajectories.

TABLE 7-7

HC AND NO$_x$ EMISSIONS (kg) ENTRAINED ALONG TRAJECTORIES

	Trajectory #1	Trajectory #2	Trajectory #3	Trajectory #4	Trajectory #5
NO$_x$					
Mobile	483	107	5278	302	213
Stationary Area	286	192	3148	198	608
Point	38	36	271	102	161
Total	807	335	8697	602	982
HC					
Mobile	475	100	5547	312	255
Stationary Area	729	321	28677	781	597
Point	3	3	41	14	18
Total	1207	424	34265	1107	870

7.4   MODELING RESULTS

7.4.1   Baseline Results

Predicted ozone and NO_2 as a function of time along the five trajectories are shown in Figures 7-6 through 7-10. These figures show the baseline results for the center column using the initial concentrations and emissions described above. Table 7-8 compares the predicted ozone concentrations to the observed values along the trajectories. The average difference between predicted and observed concentrations in Table 7-8 is 10%.

The predicted ozone concentrations along the westerly flow and easterly flow portions of trajectory #1 show gradual increases from 60 to 90 ppb and 150 to 170 ppb, respectively, between 0600 and 1200 PST. After the air from the two trajectories mixes and moves onshore at 1500 PST, the predicted ozone is 127 ppb. This result is 10% below the observed value of 140 ppb at the El Rio monitor. The predicted values for the easterly flow trajectory are within the range of O_3 observed by the aircraft offshore: 100 to 170 ppb at 1030 PST and 130 to 250 ppb at 1530 PST; however, this range is very wide. The complexity of the flow field on this day precludes placing much confidence in the trajectory model results. If the split trajectory approach employed is a reasonable approximation to the actual flow, then the small underprediction at El Rio is believed to be a result of underprediction in ozone formation along the easterly trajectory (i.e., where significantly higher O_3 levels were observed by the aircraft than were predicted by the model).

Predicted ozone concentrations along trajectory #2 gradually increase from 50 ppb at 0600 PST to 140 ppb at 1200 PST when the air parcel reaches the shoreline and the Ventura monitoring station. The model prediction is 10 ppb below the 150 ppb observed value at Ventura. A small amount of ozone scavenging (by NO_x) is predicted as the air parcel passes the coastal sources; however, these emissions generate additional ozone (approximately 20 ppb) several hours downwind when the parcel has moved into the mountain region northeast of Ojai. The off-centerline parcel column passes over the Ojai monitor at 1330 PST. The model predicts 133 ppb ozone for this column, which agrees well with the 130 ppb observation at the Ojai station. We have more confidence in the flow field for this trajectory than for trajectory #1 because of greater consistency in the wind and ozone data. For example, the Laguna Peak data indicate 130 ppb ozone in the onshore flow for hours 1100 and 1200 PST. The 1030 PST offshore data and the 1200 PST La Conchita data indicate approximately 100 ppb ozone. Thus, the onshore flow of elevated ozone concentrations is fairly wide spread on this day. The good model results on this trajectory are primarily a result of initializing the model with the correct amounts of ozone and, to a lesser extent, RHC and NO_x. Some ozone is formed along the trajectory; however, the majority is included in the 0600 PST initial values.

The results for trajectory #3 show rapidly increasing ozone concentrations as the air moves over the San Fernando Valley and into Ventura County. The model predictions lag behind the ozone observations; however, the model does predict fairly high ozone levels. The model predictions are 142 ppb ozone at Reseda (1230 PST), where 190 ppb was observed and 190 ppb at Simi Valley at 1330 PST, where 230 ppb was observed. We are fairly confident in the trajectory up to Simi Valley. After passing Simi Valley, the
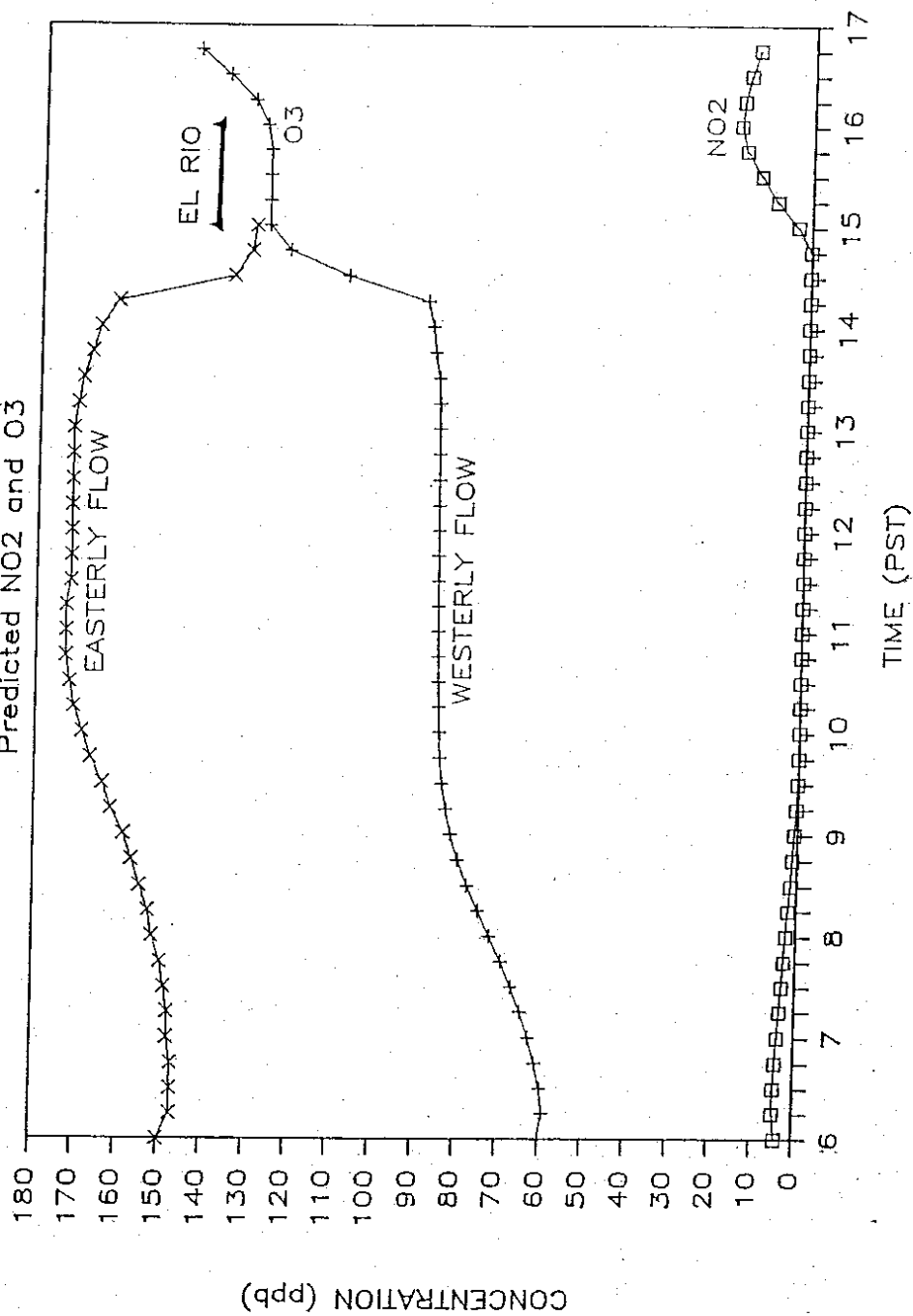
Figure 7-6. PLMSTAR Model Predictions for September 11, 1983, Trajectory #1
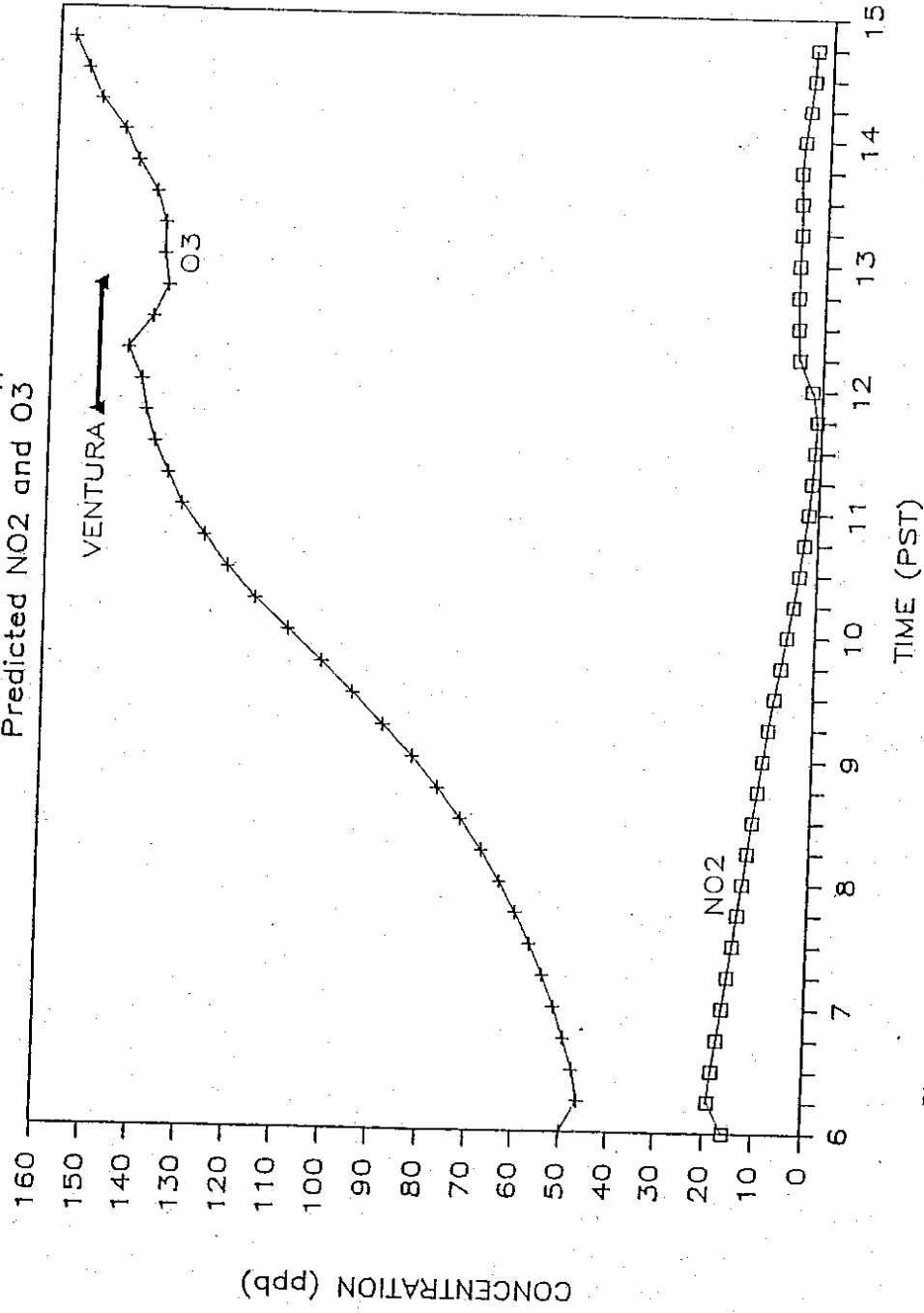
Figure 7-7. PLMSTAR Model Predictions for September 12, 1983, Trajectory #2
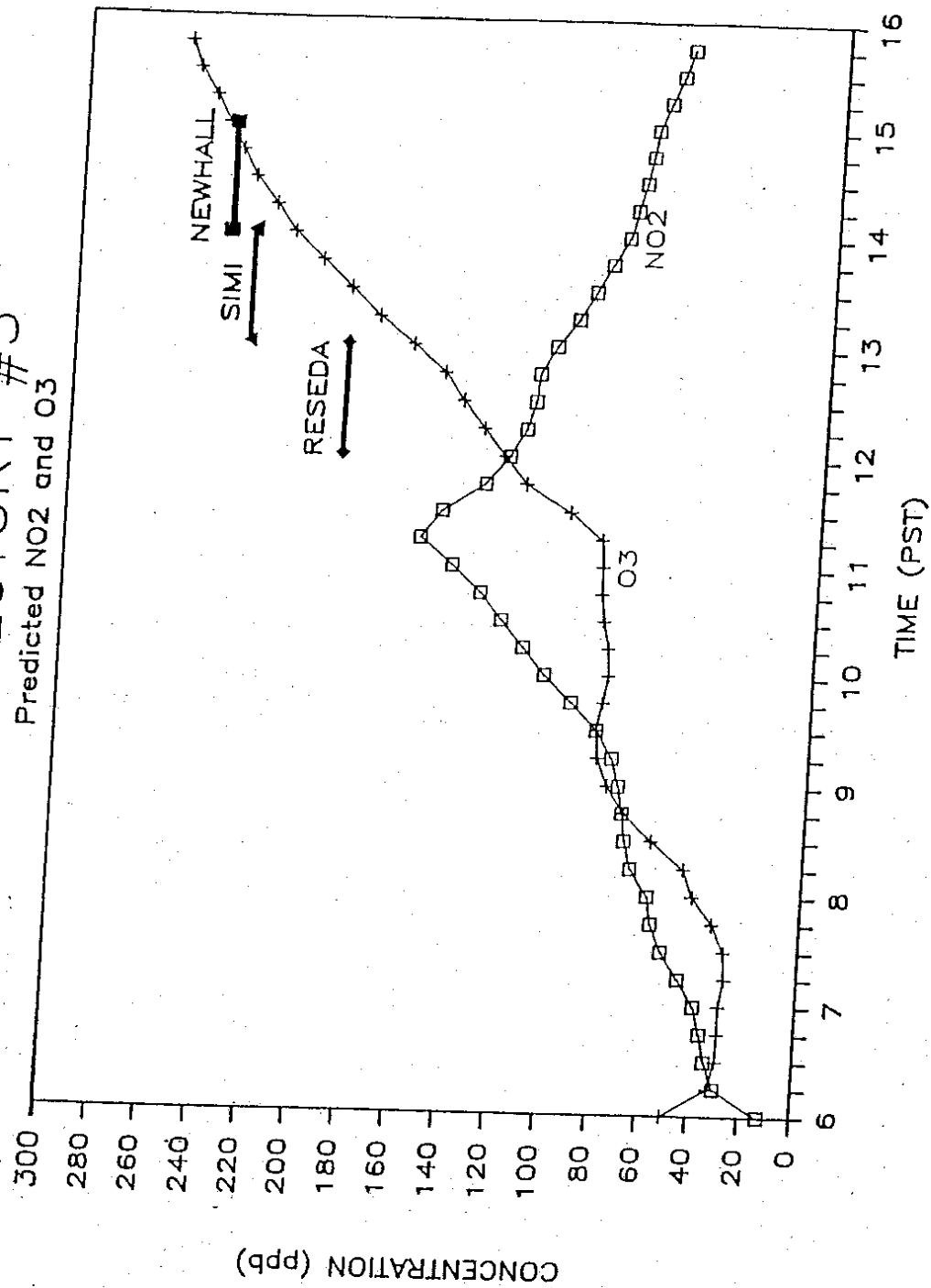
Figure 7-8. PLMSTAR Model Predictions for September 12, 1983, Trajectory #3

Figure 7-9. PLMSTAR Model Predictions for September 14, 1983, Trajectory #4

TRAJECTORY #5
Predicted NO2 and O3
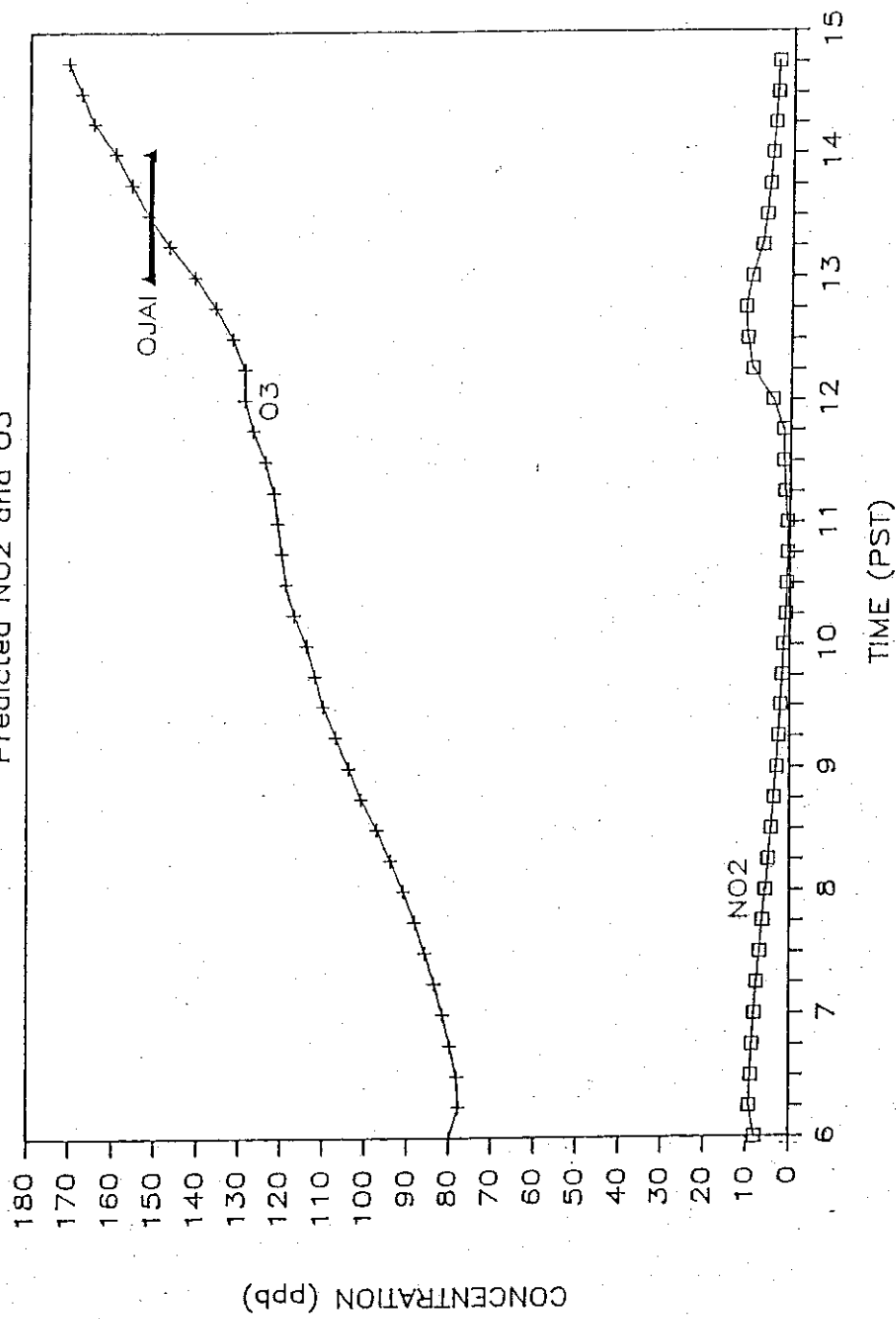
Figure 7-10. PLMSTAR Model Predictions for September 14, 1983, Trajectory #5

Table 7-8. Predicted and Observed Ozone Concentrations (ppb)

Trajectory	Station	Date	Time (PST)	Predicted	Observed	Observation / Predicted
#1	El Rio	9/11/83	1530	127	140	1.10
#2	Ventura	9/12/83	1230	139	150	1.08
	Ojai		1330	133	130	.98
#3	Reseda	9/12/83	1230	143	190	1.33
	Simi Valley		1330	190	230	1.21
	Newhall		1430	237	240	1.01
#4	Piru	9/14/83	1230	148	140	.95
#5	Ojai	9/14/83	1330	152	150	.99

trajectory is uncertain because the southeasterly flow converges with westerly sea breeze. The model prediction for the column passing Newhall at 1430 PST is 237 ppb ozone, which is close to the 240 ppb observation; however, this agreement may be fortuitous. The high ozone concentrations along this trajectory are a result of Los Angeles County RHC and NO_x emissions and high ozone levels aloft which are entrained into the mixed layer. The underprediction of ozone at Reseda and Simi Valley may be due to underestimation of the ozone levels aloft. An initial value of 150 ppb was employed in the absence of measurements; however, higher values may be justifiable since ozone in the eastern SCAB reached 370 ppb on the previous day.

Trajectory #4 is another example of ozone, formed from Los Angeles County emissions, moving up the coast and onshore the next day in Ventura County. Ozone predictions along the trajectory exceed the observations somewhat. The model predicts 130 ppb ozone at 1030 PST, when the El Rio and Ventura monitors observed 90 and 110 ppb. The model predicts 148 ppb at Piru at 1230 PST, where 140 ppb was observed. Aircraft ozone data show coastal ozone concentrations aloft of 150 to 200 ppb at 1030 PST, when the model predicts 136 ppb aloft. The overprediction of coastal station observations may be a result of overestimating the mixing height and the rate of entrainment of the ozone aloft near the coast. Coastal fog below 200 m prevented collection of temperature soundings by the aircraft, so the mixing heights employed for the simulations could easily be high. The discrepancy between observations and predictions is smaller at Piru where mixing extends to higher elevations. We are reasonably confident of the flow on this trajectory, since the available wind data and the offshore ozone aloft data during the morning hours are all consistent.

Trajectory #5 is very similar to #4, except the flow is channeled up to Ojai rather than Piru. Ozone predictions are also very similar. The model overpredicts the ozone when it passes Ventura at 1215 PST (127 vs. 80 ppb); however, it predicts 152 ppb at Ojai at 1330 PST where 150 ppb was observed. The discrepancy near the coast is again believed to be due to uncertainty in the mixing heights and the rate at which the high ozone concentrations aloft are mixed into the surface layer. As with trajectory #4, we are relatively confident in the flow pattern for this case.

In summary, the baseline results for trajectories bringing offshore ozone into Ventura County monitors are within 15 ppb, or 10% of the observed ozone maxima. We have little confidence in results for trajectory #1 because of complex offshore mixing, however, we are reasonably confident in the flow for trajectories 2, 4, and 5. Results for Trajectory #3 that bring ozone and ozone precursors over land from Los Angeles to Simi Valley show underprediction of the observed maxima by 40 ppb and 17%. The model's baseline results for these cases are reasonably good, considering the data and inherent model limitations.

7.4.2   Sensitivity to Initial Concentrations

The most uncertain parameters in the simulations of overwater ozone transport into Ventura County are the initial pollutant concentrations. One trajectory (#4 ending at Piru) was selected for performing sensitivity runs to illustrate the importance of the initial concentrations. Simulations were made with factor of 2 variations in the initial NO_x and RHC

concentrations, and ±30%variations in the initial ozone values. Table 7-9 summarizes the changes in predicted ozone concentrations at Piru for the various input changes. Figures 7-11 through 7-13 show the predicted ozone relative to the baseline predictions for these sensitivity runs.

The results for a 50% decrease in the initial NO_x show a 14 ppb or 10% decrease in the ozone concentration at the Piru station (1230 PST). A 100% increase in the initial NO_x is estimated to increase the ozone at Piru by 18 ppb or 12%. The model's ozone predictions are fairly insensitive to the large relative changes in initial NO_x in this case because the baseline NO_x is low (approximately 6 ppb column average), and the initial ozone is high (approximately 100 ppb column average). Ozone formation along the offshore portion of the trajectory is limited by the availability of NO_x rather than HC in all three runs.

The results for a 50% decrease in the initial RHC levels show lower ozone levels along most of the trajectory than those for the baseline case. At 1100 PST (Santa Paula) and 1230 PST (Piru), the ozone is predicted to be 18 ppb or 13% lower and 7 ppb or 5% lower, respectively, than in the baseline simulation. At the end of the run, however, the results with the baseline and lower initial RHC are identical. The results for the run with a 100% increase in the initial RHC show slightly higher ozone before 1100 PST and slightly lower ozone after 1100 PST than the baseline case. The ozone is 5% higher at 0900 PST, when the air comes onshore, and 8% lower at 1230 PST when the trajectory reaches Piru than the baseline case. These results illustrate the complexity of the NO_x-RHC interaction. They are perhaps best understood in terms of the familiar O_3 isopleth diagram, shown in figure 7-14. If the low RHC case corresponds to an HC/NO_x ratio along the isopleth ridge (point A), and the baseline (B) and high RHC (C) cases are in the high HC/NO_x regime, then the isopleth diagram would suggest the same sensitivity of maximum ozone to RHC. Chemically, this occurs because as the HC/NO_x ratio becomes very high, the NO_x is used less efficiently in forming ozone. In an overall sense, these results show that the computed ozone along this trajectory is not very sensitive to large changes in the RHC offshore. The 50% decrease and 100% increase produce less than 8% difference in the maximum ozone. However, RHC concentrations affect the location and time of the maximum ozone.

The results of the runs with ±30% variation in the initial ozone concentrations show ±15% to 20% change in the downwind ozone concentrations. With 30% decreased initial ozone, the prediction at Piru is 27 ppb and 18% less than in the baseline case. With 30% increased initial ozone, the prediction at Piru is 23 ppb and 16% more than the baseline results. Thus, a 30% variation in the initial ozone has more effect than factor of 2 variations in the initial RHC and NO_x. This result is consistent with the fact that incremental ozone formation from precursors is less than the initial ozone levels in these 8- to 10-hour trajectory calculations where most of the time is spent offshore.

7.4.3   Assessment of the Ozone Transport and Local Emission Components

It is relatively straightforward to estimate the contributions of inflow ozone, ozone precursors, and local emissions to Ventura County ozone on some of the trajectories considered because the high ozone observations occurred at sites near the county line or coastline which were

Table 7-9 Results of sensitivity runs using the 9/14/83
Piru trajectory as a base.

Input parameter changed	% change in input	% change in predicted ozone at Piru
NOx	-50	-10
NOx	+100	+12
RHC	-50	- 5
RHC	+100	- 8
Ozone	-30	-18
Ozone	+30	+16
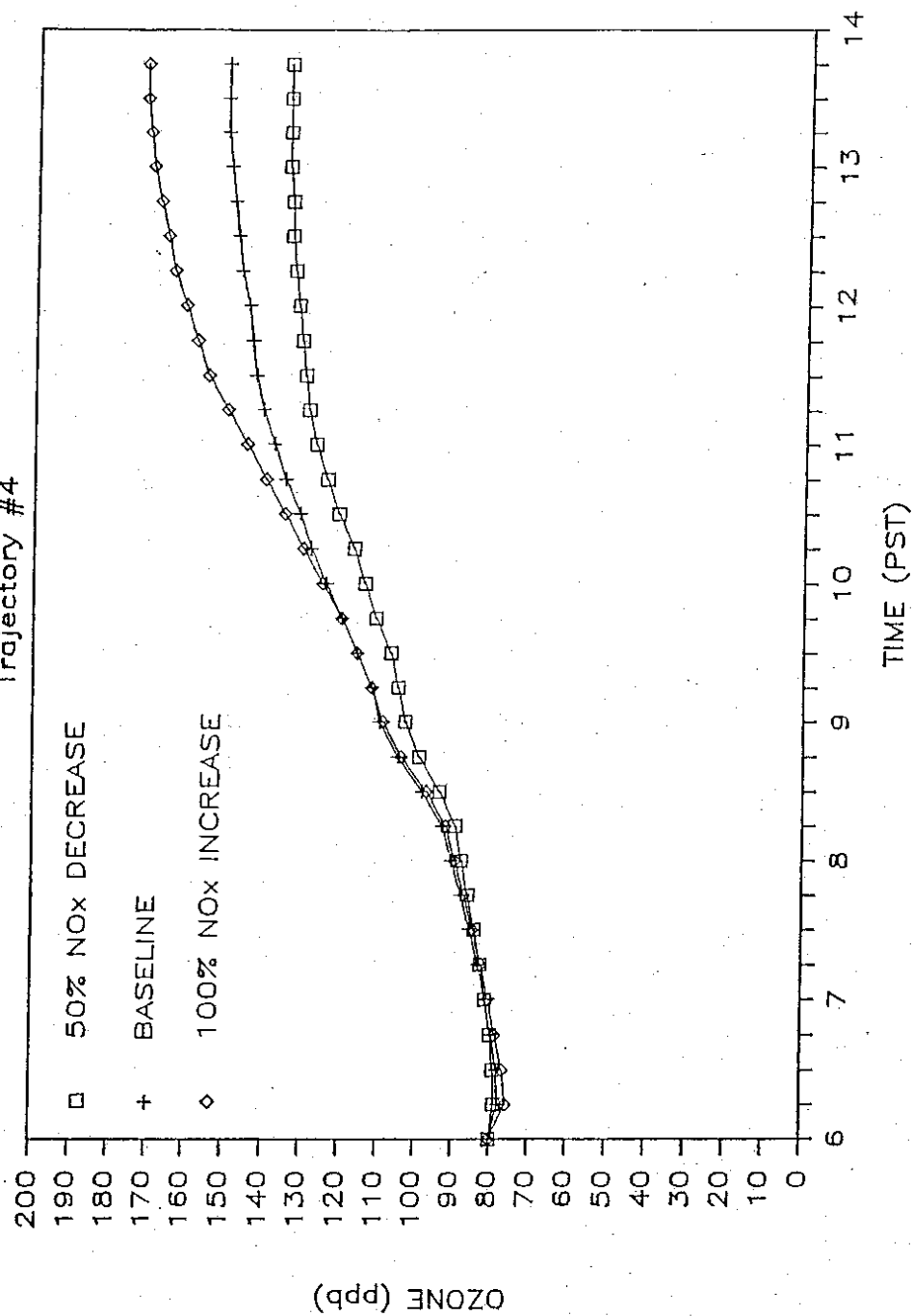
Figure 7-11. Sensitivity of Predicted Ozone to Variation in Initial NOx Concentrations

Figure 7-12. Sensitivity of Predicted Ozone to Variations in Initial RHC Concentrations

SENSITIVITY TO INITIAL O3
Trajectory #4
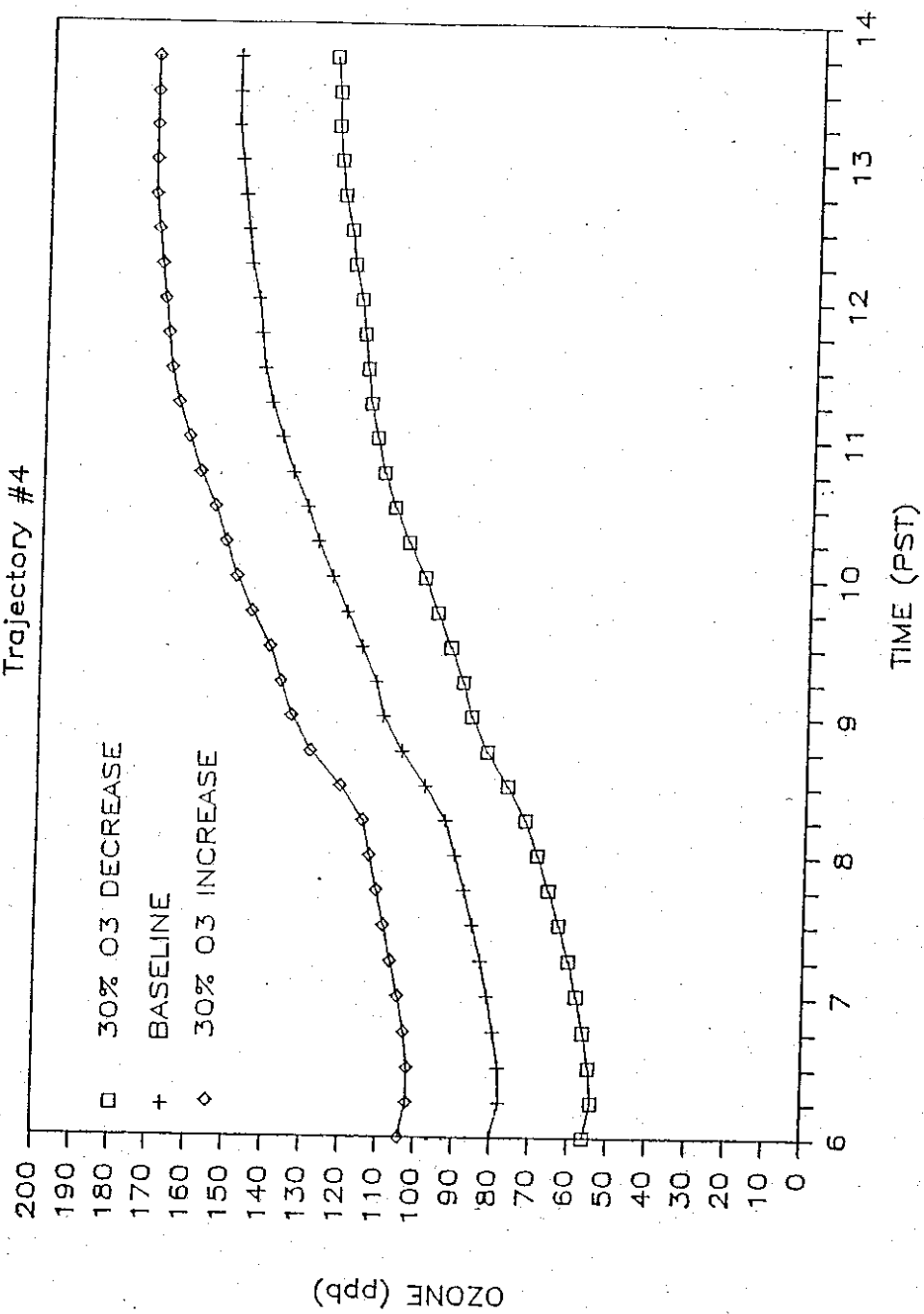
Figure 7-13. Sensitivity of Predicted Ozone to Variations in Initial Ozone Concentrations
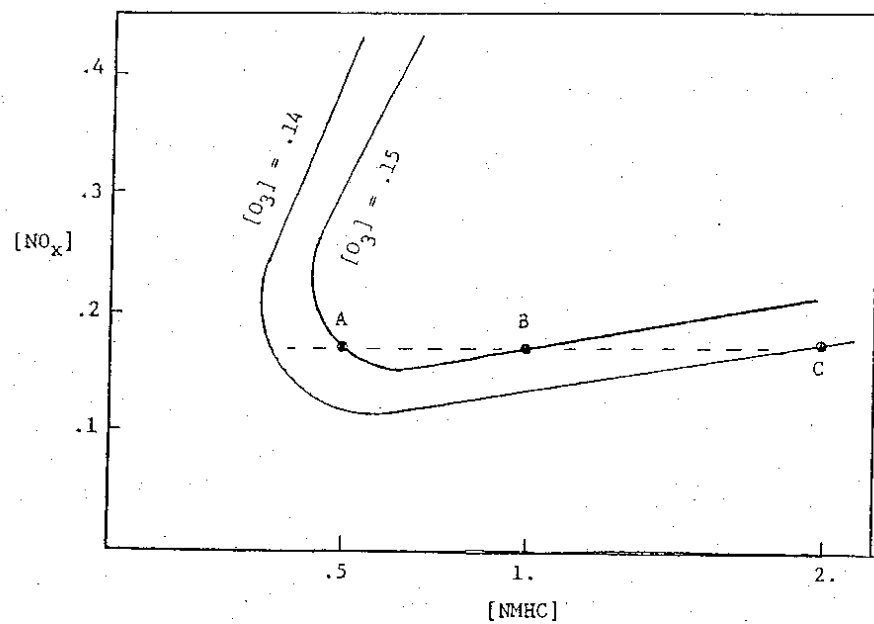
Figure 7-14. Generic Ozone Isopleth Diagram

essentially not influenced by Ventura County emissions. The trajectories arriving at El Rio on September 11 and at Ventura and Simi Valley on September 12 are examples of high ozone occurrences where the contribution of local emissions is essentially zero. The transport component for these cases is approximately the difference between the observed ozone maxima and typical summer background ozone levels, 40 to 60 ppb. That is, we assume all inflow air at the Ventura County boundaries would contain 50 ppb of ozone (natural summer background) if there were no emissions in the neighboring air basins. Also, since the stations are a few miles from the County boundaries, it is assumed that a small amount of ozone (5 ppb) could be formed between the boundary and the station. The ozone in excess of 55 ppb is the transport component due to emissions outside of Ventura County. Therefore, the transport components at El Rio on September 11th and Simi Valley on September 12th were 85 and 175 ppb, respectively.

The photochemical model was used to estimate the transport and local emission components of the high ozone observations for September 14 trajectories which entrain significant Ventura County emissions prior to arriving at the ozone monitors at Piru and Ojai. Simulations were made with 50 ppb O_3, 1 ppb NO_x, and 150 ppb RHC initial concentrations at all levels of the air parcels to represent clean inflow conditions. The predicted ozone concentrations for these runs are shown in Figures 7-15 and 7-16. The difference between the baseline and clean results is the estimated transport component. At the Piru station on trajectory #4, the transport component is 67 ppb. At Ojai on trajectory #5, the transport component is 78 ppb. These transport components are approximately half of the observed maxima. It is clear from these results that it would be very unlikely for Ventura County emissions to generate sufficient ozone to exceed the 120 ppb federal standard under these meteorological conditions if it were not for the elevated ozone concentrations offshore.

The local emission components for these two trajectories have been estimated by simulating the trajectory with the baseline initial concentrations and without the Ventura County emissions. Without emissions, the predicted ozone is 125 ppb at Piru on trajectory #4 and 123 ppb at Ojai on trajetory #5. Hence, the emissions are predicted to contribute 23 ppb or 16% to the ozone maximum at Piru and 29 ppb or 19% to the ozone maximum at Ojai on this day. These estimates are quite uncertain because the initial or transported concentrations are poorly known. The local components could be substantially higher if the actual HC concentrations offshore were lower. The important point to recognize here is the ozone forming potential of local emissions depends strongly on the HC/NO_x ratio and, to a lesser extent, the O_3 concentration of inflowing air.

Table 7-10 summarizes the estimates for the local and transport components of the observed ozone on the trajectories. The estimates show that the summer background ozone accounts for 22 to 35% of the observed maxima. The local components account for 0 to 19% of the ozone maxima. The transport component accounts for 47 to 76% of the ozone maxima. Thus, for these days with south-southeast flow in the morning hours, the transport component is the largest contributor to the observed ozone. This result is consistent with the fact that the SCAB RHC and NO_x emissions are more than an order of magnitude greater than Ventura County emissions; that maximum ozone from RHC and NO_x emissions is generally expected to occur 30-60 km downwind of the source location and that ozone loss processes are
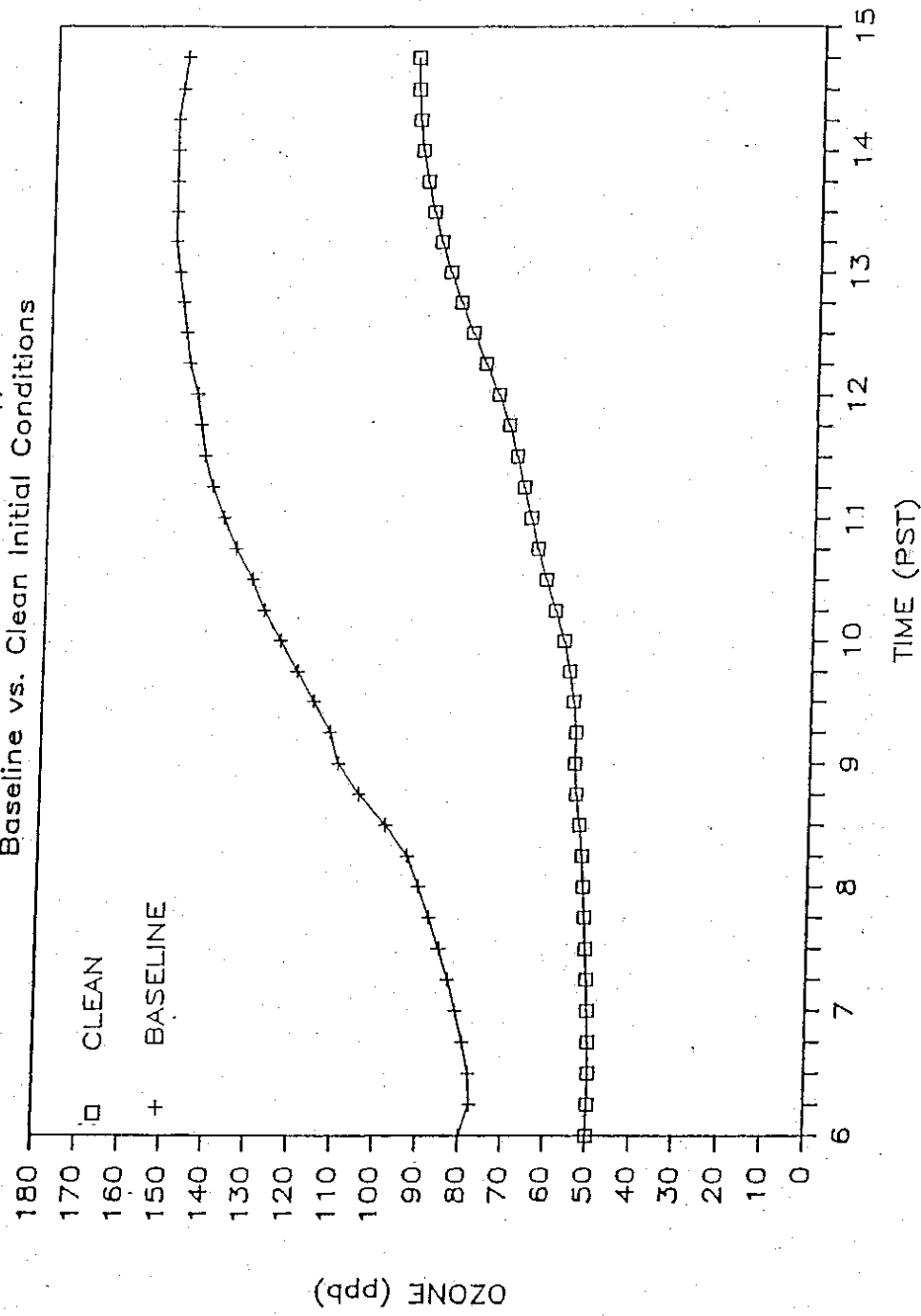
Figure 7-15. Predicted Ozone Concentrations on Trajectory #4 with Clean and Baseline Initial Concentrations
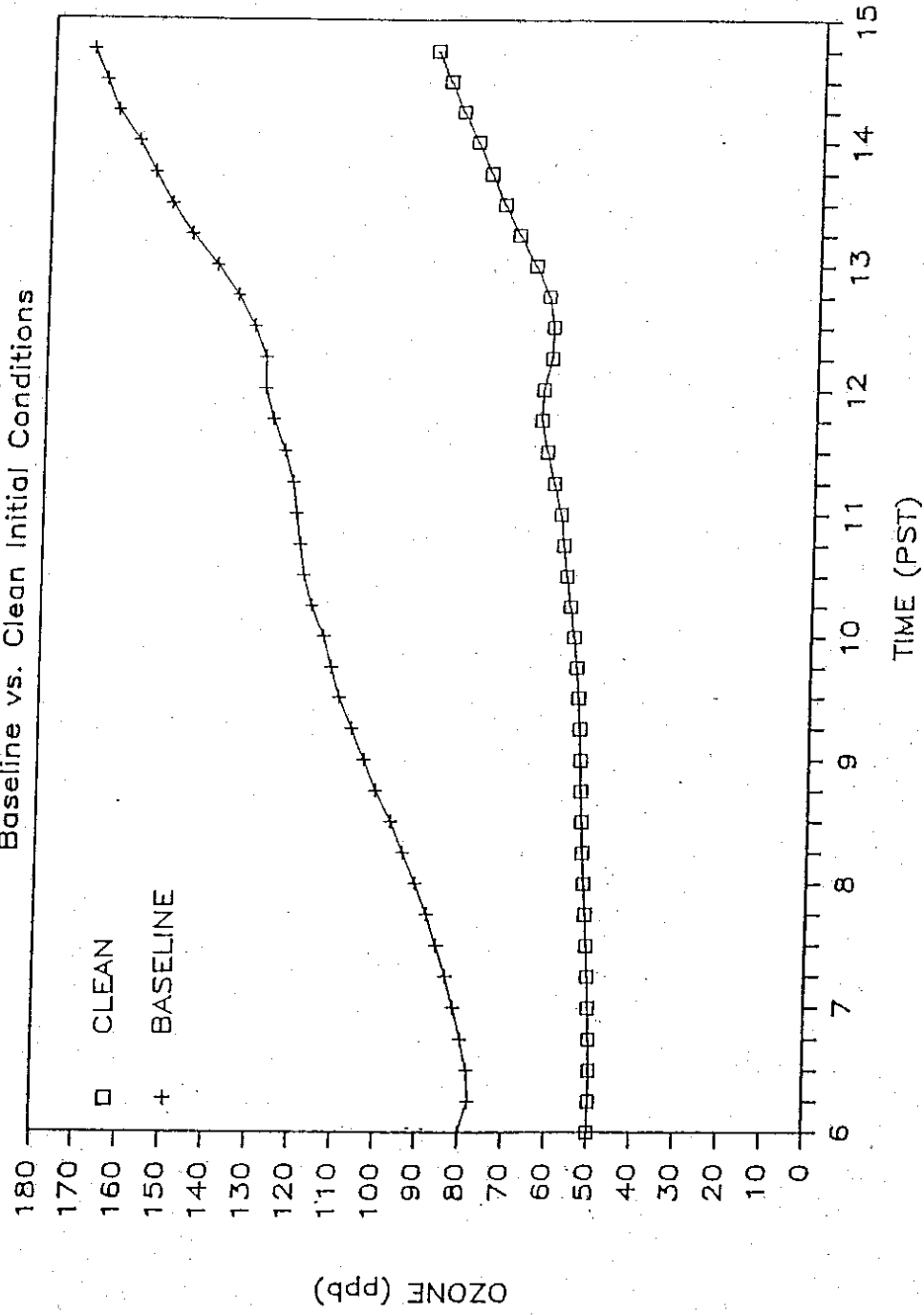
Figure 7-16. Predicted Ozone Concentrations on Trajectory #5 with Clean and Baseline Initial Concentrations

Table 7-10. Estimated Components of the Observed Ozone (ppb)

Trajectory	Station	Background	Transport Component	Local Component	Total Ozone
1	El Rio	50	> 85	< 5	140
2	Ventura	50	> 95	< 5	150
3	Simi Valley	50	> 175	< 5	230
4	Piru	50	67	23	140
5	Ojai	50	71	29	150

very slow over water and in elevated layers which are decoupled from the surface.

The transport components indicated above are substantially higher than the average transport components of 10-20 ppb ozone indicated by the statistical analysis in Section 5. However, the definition of the transport component is quite different in the two analyses. The definition in the statistical analysis is the difference in Ventura County ozone maxima on days with and without 1000 PST 3000' winds suggesting transport from Los Angeles to Ventura County. Hence, it basically contrasts the ozone on days with different meteorological flow patterns. For the modeling analysis, the transport component is defined as the contribution of the non-Ventura County emissions component on high ozone days when there was persistent meteorological transport from Los Angeles County. Thus, the two results are not directly comparable. Nevertheless, the large difference between the two results deserve comment. Besides the difference in the definition, the large difference is due to the fact that the modeling analyses were performed for five documented cases of ozone transport that were chosen for their high transport contributions. These five cases are at the extreme end of the distribution of days that would be classified as "transport" days in the statistical analysis. Had the modeling days been selected randomly from the "transport" days identified in the statistical analysis, the modeled transport component most likely would have been much smaller.

7.4.4   Summary of Modeling Results

In summary, the photochemical model was run for five trajectories on three days with strong evidence of ozone transport from Los Angeles to Ventura Counties. Even though the trajectory model uses a very simple representation of the complex flow fields and many of the model inputs are uncertain, the model predictions for ozone at key receptor stations agree fairly well, +/- 20% or better with the observed concentrations. Some diagnostic adjustment of uncertain model inputs was performed to improve agreement between the predictions and observations. Sensitivity analysis was performed to quantify the importance of the initial HC, NO_x and O_3 concentrations that were adjusted. Simulations were also carried out to assess the contributions of local emissions and transported ozone and its precursors.

In general, the photochemical modeling results are entirely consistent with the analysis of the case studies presented in Section 3. The results suggest that a large fraction of the ozone concentrations observed in Ventura County on days with southeasterly winds aloft may be due to transport of ozone and its precursors into the County from Los Angeles County. The transport component may be especially large when Santa Ana winds occur after episodic ozone levels are formed in the South Coast Air Basin. The model and input data used for the analysis are too uncertain to precisely quantify the contributions of transported ozone and its precursors; however, the results qualitatively confirm that the contribution may be large under certain meteorological conditions. The results also indicate that reduction of HC and NO_x emissions in Ventura County may have little or no effect on maximum ozone concentrations in the County under certain meteorological conditions. Thus, it should be recognized that Ventura County can be a downwind receptor for ozone generated from SCAB emissions much like Riverside and San Bernardino Counties.

8. REFERENCES

California Air Resources Board (1978-1983) California Air Quality Data, Volumes X - XV, Aerometric Data Division Reports.

Dabberdt, W. F., Viezee, W. and Nitz, K. C. (1985) SCCCAMP Field Study Design Volume I: Monitoring Network. Prepared for South Central Coast Cooperative Aerometric Monitoring Program (SCCCAMP). SRI Project 8331.

Godden, D. A. and Lague, J. S. (1983) Assessment of the Transport of Ozone and its Precursors between Los Angeles and Ventura Counties. ERT Document No. P-B528-100. Prepared for the Western Oil and Gas Association.

Godden, D. A., Lurmann, F. W. and Collins, H. M. (1985) User's Guide to the PLMSTAR Air Quality Simulation Mode, ERT Document No. M-2206-100. Environmental Research and Technology, Inc., Newbury Park, CA.

Kauper, E. and Niemann, B. L. (1975) Los Angeles to Ventura Over Water Ozone Transport Study. Final Report to the California Air Resources Board by Metro Monitoring Services.

Lea, D. A. (1968) Vertical Ozone Distribution in the Lower Troposphere Near an Urban Pollution Complex, Journal of Applied Meteorology , 7, 252.267.

Lehrman, D. E., Smith, T. B., Reible, D. D. and Shair, F. H. (1981) A Study of Transport Into, Within and Out of Coastal Areas of Southern Santa Barbara County and Ventura County. Final Report MRI 81 FR-1808. Submitted to the Ventura Air Pollution Control District.

Lehrman, D. E., Blumenthal, D. L. and Countess, R. J. (1983) Ventura County Ozone Transport Study - Final Report, December 1983. Sonoma Technology, Inc., Santa Rosa, CA.

McElroy, 1983...

Shair, F. H. Sasaki, E. J., Carlan, D. E., Cass, G. R. and Goodin, W. R. (1982) Transport and Dispersion of Airborne Pollutants Associated with the Land-Sea Breeze System. Atmos. Environ. 16, 2043-2053.

Smith, T. B., Saunders, W. D. and Shair, F. H. (1983) Analysis of Santa Barbara Oxidant Study. MRI Final Report to the California Air Resources Board.

Strange, R. R. and Hovind E. L. (1976) Synoptic Weather Patterns Related to Ozone Concentrations in Santa Barbara, Calfiornia. NAWC Report #794-A to Dames and Moore.

APPENDIX A

SELECTED DATA FROM THE VCOT STUDY

SEPTMEBER 1 – OCTOBER 6, 1983

Table A-1			DAILY MAXIMUM OZONE LEVELS DURING VCOT STUDY					
			(PPHM)					
	<------------------VALLEY SITES------------------>					<--ELEVATED SITES-->		
DATE	EL RIO	OJAI	PIRU	SIMI	THOUSAND OAKS	VENTURA	LAGUNA PEAK	ROCKET-DYNE	REGIONAL MAX
9/2	5	8	8	9	8	9		9	9
9/3	5	11	12	13	11	6		15	15
9/4	7	9	11	11	12	4		14	14
9/5	9	10	11	12	11			16	16
9/6	7	12	13	15	13	9		17	17
9/7	5	10	10	14	9	6	7	15	15
9/8	5	7	7	10	9	5	5	10	10
9/9	6	7	7	6	8	6	6	7	8
9/10	12	11	11	11	15	8	11	14	15
9/11	14	8	11	10	12	10	11	11	14
9/12	7	14	17	23	18	15	13	28	28
9/13	13	12	15	16	13	13	14	18	18
9/14	10	15	14	15	12	12	14	19	19
9/15	8	12	13	15	10	10	11	17	17
9/16	7	9	12	15	9	9	17	14	17
9/17	8	13	14	17	12	5	15	18	18
9/18	7	10	12	15	10	4	15	14	15
9/19	10	12	11	12	10	14	15	13	15
9/20	5	6	6	10	6	6	7	9	10
9/21	2	5	5	7	3	5	2	5	7
9/22	3	5	4	7	4	5		7	7
9/23	6	6	6	8	6	6		7	8
9/24	7	8	9	11	9		7	11	11
9/25	7	8	8	10	8		7	10	10
9/26	5	5	5	7	5	5	5	5	7
9/27	6	6	7	9	8	7	8	8	9
9/28	4	5	5	6	5	8	6	5	8
9/29	5	4	4	6	4	6		3	6
9/30	3	3	3	3	4	5		3	5
10/1	4	4	3	6	5	5		4	6
10/2	4	4	4	7	5	5		6	7
10/3	6	7	7	9	9	7		9	9
10/4	6	8	6	15	11	7	6	14	15
10/5	5	6	5	8	6	7	5	7	8
10/6	5	7	5	9	10	7	8	11	11

TABLE A-2   DAILY MAXIMUM OZONE LEVELS AT UPWIND SOUTH COAST SITES
(pphm)

DATE	LENNOX	WEST LA	RESEDA	BURBANK	UPWIND AREA MAX	UPWIND AREA MAX PREVIOUS DAY
9/1	4	9	9	18	18	
9/2	6	16	24	22	24	18
9/3	8	13	14	19	19	24
9/4	6	10	13	20	20	19
9/5	11	15	16	22	22	20
9/6	7	9	13	27	27	22
9/7	5	12	16	13	16	27
9/8	4	7	11	14	14	16
9/9	7	14	7	15	15	14
9/10	14	23	17	19	23	15
9/11	18	19	13	20	20	23
9/12	7	11	20	15	20	20
9/13	8	14	20	22	22	20
9/14	6	16	18	25	25	22
9/15	7	11	9	28	28	25
9/16	6	12	16	28	28	28
9/17	10	19	16	23	23	28
9/18	12	20	19	22	22	23
9/19	4	11	12	11	12	22
9/20	2	3	8	5	8	12
9/21	3	5	10	10	10	8
9/22	3	4	9	7	9	10
9/23	4	6	10	9	10	9
9/24	4	6	11	8	11	10
9/25	5	11	10	14	14	11
9/26	4	4	4	5	5	14
9/27	3	5	7	5	7	7
9/28	3	4	4	3	4	7
9/29	3	3	3	3	3	4
9/30	1	1	1	2	3	3
10/1	3	3	5	4	5	3
10/2	4	5	5	7	7	5
10/3	8	12	7	11	12	7
10/4	4	7	11	16	16	12
10/5	3	4	8	5	8	16
10/6	10	11	13	13	12	8

DATE	VANDENBERG 0400 PST 850 MB TEMP, °C	Bkg O3 Aloft (pphm)	CALCULATED MAX MIX HEIGHT(FT MSL)	MAX O3 IN ELEVATED LAYERS(pphm) (MORN, MIDDAY)	PT. MUGU 3000' 10 PST WIND DIR. (°)
9/1	17.3			10	
9/2	21.4	3	2300	10	273
9/3	21.8	5	1750	16	
9/4	18.1	5		16	
9/5	21.4	7	2200	15	
9/6	23		2800		128
9/7	21.7	4	2100	19	
9/8	18.4	3	2000	9	152
9/9	19.8	3	2600		158
9/10	23.5	3			
9/11	24.5	5		18	
9/12	25.5	7	1600	16	132
9/13	25.6		2200		120
9/14	24.6	6	2200	19	230
9/15	25.6	6	1400	17	128
9/16	24.4	7	2500	27	86
9/17	22.8	9	2050	17	135
9/18	22.1	8	2400	19	78
9/19	22.5		1850		120
9/20	21.2	5	2950	10	78
9/21		2	3300		117
9/22	14.8	1	1750		167
9/23	13.4	3	3250		113
9/24	13.2				
9/25	13.7		3800		111
9/26	7.9	4	3800		231
9/27	10.3		4000		
9/28	10.2		1300		
9/29	8.8		200		
9/30	6.3		1200		
10/1	7.2				
10/2	8.1				
10/3	10.6	6			
10/4	15.3	5	2200		
10/5	13.5	5	2300		
10/6	14.3		3500		

TABLE A-3   ADDITIONAL AIR QUALITY AND METEOROLOGY DATA

APPENDIX B

AIR QUALITY AND UPPER AIR DATA FOR JUNE-OCTOBER, 1980-1983

Date		Daily Maximum Ozone (pphm)										Vandenberg AFB 0400 PST Sounding 850 mb		Pt. Mugu 1000 PST 3000 ft. winds	
	Rocketdyne	Simi Valley	El Rio	Thousand Oaks	Ojai	Piru	Ventura	Burbank	Reseda	Lennox	West L.A.	Height (msl)	Temp (°C)	Dir (°)	Spd (kts)
6/ 1/80	-	7	5	6	6	6	6	5	8	4	4	1484	9.5	-	-
6/ 2/80	-	6	5	6	6	6	5	4	6	3	4	1469	12.4	119	6
6/ 3/80	-	7	5	7	7	7	6	7	8	3	5	1429	9.8	132	3
6/ 4/80	-	9	4	7	8	8	5	8	11	4	8	1496	8.4	0	0
6/ 5/80	-	6	4	6	5	6	5	6	7	3	5	1483	8.1	136	3
6/ 6/80	-	7	6	6	8	6	7	10	10	5	9	1489	9.4	100	3
6/ 7/80	-	10	8	10	10	9	5	13	15	9	10	1512	10.6	-	-
6/ 8/80	-	11	7	9	10	12	6	19	18	9	15	1540	15.1	-	-
6/ 9/80	-	10	8	9	11	10	6	20	20	4	10	1528	16.4	149	2
6/10/80	-	11	7	8	9	9	5	10	12	5	10	1499	15.7	257	5
6/11/80	-	11	4	7	10	11	5	15	14	5	8	1510	15.8	309	4
6/12/80	-	11	8	7	9	9	6	10	8	5	12	1524	10.7	203	1
6/13/80	-	7	5	6	10	9	5	12	12	4	9	1518	10.8	259	3
6/14/80	-	8	6	8	9	9	5	11	10	5	10	1515	10.8	-	-
6/15/80	-	9	7	10	9	9	6	23	23	10	17	1529	15.0	-	-
6/16/80	-	10	6	10	10	12	5	16	23	5	6	1515	18.5	0	0
6/17/80	-	13	7	9	9	12	6	13	14	4	7	1497	19.5	129	6
6/18/80	-	10	5	9	9	12	7	16	15	8	11	1513	18.4	295	2
6/19/80	-	12	5	10	10	13	6	20	15	2	10	1512	18.3	127	2
6/20/80	-	10	5	10	11	13	3	17	12	1	10	1508	17.9	158	4
6/21/80	-	12	8	13	10	13	-	20	16	3	11	1516	15.7	-	-
6/22/80	-	12	9	13	8	12	-	20	19	5	16	1513	15.9	-	-
6/23/80	-	8	6	8	8	10	-	11	11	-	8	1510	14.8	263	3
6/24/80	-	12	6	10	7	11	-	11	10	-	9	1490	14.0	113	5
6/25/80	-	13	6	10	10	9	5	17	16	4	8	1506	15.3	294	3
6/26/80	-	13	10	13	11	11	5	21	21	7	17	1518	16.5	304	2
6/27/80	-	18	12	17	15	18	6	35	21	9	21	1530	23.3	115	7
6/28/80	-	10	7	8	10	12	8	12	13	8	11	1529	23.2	-	-
6/29/80	-	9	4	7	9	10	4	19	13	2	13	1526	21.2	-	-
6/30/80	-	15	3	8	8	8	4	13	16	3	7	1510	20.0	278	16
7/ 1/80	-	7	4	6	6	8	3	4	6	1	3	1523	18.5	110	17
7/ 2/80	-	8	2	-	5	6	3	7	9	2	3	1540	12.4	125	15
7/ 3/80	-	7	4	-	7	8	4	11	11	7	8	1554	13.4	284	7
7/ 4/80	-	10	6	1	10	11	4	21	21	6	13	1530	16.8	-	-
7/ 5/80	-	10	5	8	10	11	4	21	20	-	17	1522	16.9	-	-
7/ 6/80	-	14	6	10	1	13	4	17	13	-	9	1516	17.1	-	-
7/ 7/80	-	13	6	9	9	10	4	13	12	6	9	1503	17.4	179	1
7/ 8/80	-	10	5	6	6	8	3	12	9	4	8	1510	15.9	249	2
7/ 9/80	-	7	4	6	5	7	3	13	11	4	11	1516	14.7	297	8
7/10/80	-	7	4	7	7	8	4	13	12	5	12	1530	19.8	291	4
7/11/80	-	8	4	9	9	12	4	24	23	5	20	1536	21.8	298	15
7/12/80	-	10	5	6	10	12	3	13	10	5	8	1519	19.5	-	-
7/13/80	-	12	8	10	10	12	6	12	12	1	11	1515	15.6	-	-
7/14/80	-	11	6	8	8	8	6	13	10	7	12	1532	16.2	122	3
7/15/80	-	7	4	7	7	8	4	17	18	6	13	1535	17.4	160	3

Daily Maximum Ozone (pphm)

Date	Rocketdyne	Simi Valley	El Rio	Thousand Oaks	Ojai	Piru	Ventura	Burbank	Reseda	Lennox	West L.A.	Vandenberg AFB 0400 PST Sounding 850 mb Height (msl)	Temp (°C)	Pt. Mugu 1000 PST 3000 ft. winds Dir (°)	Spd (kts)
7/16/80	-	7	3	7	10	9	3	15	14	4	8	1560	22.1	295	12
7/17/80	-	13	5	7	10	12	3	16	20	3	11	1544	23.6	288	7
7/18/80	-	12	7	9	13	13	4	14	19	3	7	1511	22.6	184	4
7/19/80	-	17	12	13	14	16	6	16	16	4	8	1507	23.1	-	-
7/20/80	-	16	8	10	10	12	7	21	18	7	12	1504	22.1	-	-
7/21/80	-	12	7	10	8	12	6	15	22	5	7	1517	23.3	0	0
7/22/80	-	17	7	12	11	13	6	19	19	3	8	1530	24.7	100	2
7/23/80	-	17	6	13	15	15	5	17	18	4	10	1531	26.4	196	2
7/24/80	-	17	4	10	15	15	5	15	20	4	8	1510	25.8	276	3
7/25/80	-	-	7	13	17	17	5	19	19	4	12	1513	26.8	159	4
7/26/80	-	-	7	11	17	15	6	19	23	3	7	1516	26.6	-	-
7/27/80	-	-	6	10	11	12	5	17	21	4	9	1516	26.2	-	-
7/28/80	-	-	7	12	13	13	5	19	21	3	8	1508	26.7	276	8
7/29/80	-	-	8	14	15	12	5	34	24	5	16	1514	25.0	240	1
7/30/80	-	-	5	9	7	11	5	14	11	7	13	1535	25.8	271	11
7/31/80	-	-	8	10	13	13	7	16	18	4	11	1541	23.7	0	0
8/ 1/80	-	-	10	14	12	15	6	22	22	8	11	1551	23.9	128	4
8/ 2/80	-	-	2	11	13	15	6	12	14	4	7	1545	24.3	-	-
8/ 3/80	-	-	-	8	11	12	5	10	12	4	5	1520	26.9	-	-
8/ 4/80	-	-	-	9	11	10	6	9	13	4	6	1481	23.1	116	7
8/ 5/80	-	-	5	7	8	10	5	12	11	3	7	1477	21.3	117	5
8/ 6/80	-	-	5	10	9	11	6	9	9	7	9	1493	22.5	146	5
8/ 7/80	-	-	8	11	11	11	5	18	21	5	9	1509	24.0	283	4
8/ 8/80	-	-	6	10	13	14	5	26	23	4	13	1494	25.2	307	8
8/ 9/80	-	-	8	15	17	18	7	29	30	5	-	1491	26.2	-	-
8/10/80	-	-	7	12	17	17	6	24	17	9	-	1498	26.6	-	-
8/11/80	-	-	11	13	18	16	5	19	30	10	12	1505	27.5	182	2
8/12/80	-	3	12	14	17	17	5	10	19	3	8	1501	27.5	71	2
8/13/80	-	7	6	7	9	9	6	5	11	3	4	1491	24.3	127	14
8/14/80	-	6	6	6	7	7	6	7	10	4	6	1481	19.8	130	10
8/15/80	-	6	6	6	7	7	5	7	9	3	5	1483	16.9	99	4
8/16/80	-	6	5	5	7	7	5	6	11	3	5	1494	17.1	-	-
8/17/80	-	8	6	9	7	9	5	11	15	4	6	1493	17.6	-	-
8/18/80	-	5	4	5	6	5	5	5	8	3	3	1473	14.9	126	11
8/19/80	-	4	4	5	5	6	4	6	8	3	4	1473	9.4	104	9
8/20/80	-	8	3	6	6	7	4	8	13	3	5	1522	15.1	48	4
8/21/80	-	10	6	9	9	9	5	10	14	5	8	1523	18.6	106	3
8/22/80	-	10	6	6	8	10	8	9	12	5	7	1481	17.3	121	12
8/23/80	-	7	7	7	10	10	7	9	9	4	6	-	-	-	-
8/24/80	-	6	6	7	8	9	5	8	6	5	6	1510	14.9	-	-
8/25/80	-	8	7	7	9	10	6	7	7	5	9	1526	16.4	113	5
8/26/80	-	6	7	6	8	7	6	10	11	4	7	1532	18.2	141	3
8/27/80	-	8	7	8	9	11	6	11	12	4	6	1528	18.3	136	2
8/28/80	-	11	8	9	9	12	6	17	9	8	11	1526	17.1	151	6
8/29/80	-	10	9	10	13	9	6	12	11	6	13	1538	19.0	257	6
8/30/80	-	5	6	7	12	9	4	10	8	3	8	1544	7.1	-	-

Daily Maximum Ozone (pphm)

Date	Rocketdyne	Simi Valley	El Rio	Thousand Oaks	Ojai	Piru	Ventura	Burbank	Reseda	Lennox	West L.A.	Vandenberg AFB 0400 PST Sounding 850 mb Height (msl)	Temp (°C)	Pt. Mugu 1000 PST 3000 ft. winds Dir (°)	Spd (kts)
8/31/80	-	7	7	8	10	11	5	10	13	5	8	1510	14.7	108	10
9/ 1/80	-	11	8	8	10	11	5	14	16	6	10	1499	17.4	-	-
9/ 2/80	-	10	9	7	9	12	8	15	17	5	11	1502	18.1	106	4
9/ 3/80	-	14	10	12	13	13	10	24	19	8	15	1506	18.8	102	9
9/ 4/80	-	14	11	13	14	14	10	19	23	7	11	1520	20.1	146	7
9/ 5/80	-	11	10	11	13	12	8	14	16	4	9	1537	21.4	132	5
9/ 6/80	-	7	7	8	9	13	6	10	8	5	7	1530	19.9	-	-
9/ 7/80	-	5	7	6	7	8	7	5	7	3	4	1493	16.3	-	-
9/ 8/80	-	7	6	6	-7	9	5	5	8	4	5	1481	10.9	0	0
9/ 9/80	-	7	-	6	9	10	5	6	11	4	5	1509	13.6	58	4
9/10/80	-	9	-	7	9	10	6	10	14	5	8	1523	16.5	28	8
9/11/80	-	11	9	9	11	12	8	19	20	8	13	1517	16.9	186	1
9/12/80	-	14	11	12	13	16	9	18	19	8	13	1496	17.8	132	4
9/13/80	-	8	8	7	8	8	8	7	9	4	6	1485	17.1	-	-
9/14/80	-	6	5	7	7	7	6	7	8	4	5	1481	8.5	-	-
9/15/80	-	8	6	6	8	8	6	9	10	3	6	1489	13.9	113	7
9/16/80	-	7	5	8	8	9	5	13	10	4	8	1500	13.2	301	9
9/17/80	-	6	6	7	9	7	6	26	20	9	20	1523	19.6	188	4
9/18/80	-	4	4	4	7	7	2	10	6	2	3	1514	15.6	209	5
9/19/80	-	5	5	5	7	7	4	7	9	3	6	1519	11.7	0	0
9/20/80	-	7	8	11	9	13	8	12	13	5	8	1511	14.5	-	-
9/21/80	-	7	7	9	8	10	5	13	14	7	11	1487	14.6	-	-
9/22/80	-	10	8	9	10	11	8	13	15	4	9	1498	15.5	78	11
9/23/80	-	7	9	8	11	10	9	13	14	4	8	1526	20.0	54	22
9/24/80	-	10	8	10	9	11	9	17	19	10	14	1511	20.3	52	20
9/25/80	-	10	6	12	14	12	6	18	18	5	12	1490	23.8	66	5
9/26/80	-	15	6	11	14	16	6	21	24	6	8	1501	21.0	292	5
9/27/80	-	8	5	9	10	16	5	17	22	5	9	1506	22.1	-	-
9/28/80	-	7	9	11	10	12	7	19	17	8	12	1497	20.0	-	-
9/29/80	-	12	8	11	12	16	8	21	21	7	9	1518	23.2	99	10
9/30/80	-	11	12	16	9	14	9	25	22	6	13	1559	25.0	60	17
10/ 1/80	-	11	11	15	9	15	7	24	13	5	11	1553	25.3	53	13
10/ 2/80	-	17	13	19	15	21	13	29	38	8	17	1553	27.0	62	20
10/ 3/80	-	17	12	17	15	19	11	25	33	8	16	1556	27.4	53	6
10/ 4/80	-	9	12	12	16	15	11	25	27	8	16	1547	26.2	-	-
10/ 5/80	-	7	10	12	13	14	7	16	16	8	10	1552	23.8	-	-
10/ 6/80	-	12	8	13	11	13	7	16	21	7	8	1554	24.2	302	5
10/ 7/80	-	14	10	15	13	15	10	26	27	10	13	1555	23.4	66	12
10/ 8/80	-	14	9	13	13	13	11	17	23	4	10	1536	24.7	352	3
10/ 9/80	-	15	11	15	13	16	9	19	21	8	14	1521	22.5	247	3
10/10/80	-	14	9	12	15	17	9	21	23	7	13	1520	22.1	294	8
10/11/80	-	-	13	16	9	15	7	25	15	9	17	1520	16.7	-	-
10/12/80	-	-	7	13	9	12	7	15	17	10	13	1514	15.2	-	-
10/13/80	-	-	7	7	7	7	6	5	6	4	6	1502	10.5	-	-
10/14/80	-	-	-	5	5	7	4	4	4	3	5	1492	5.8	245	4
10/15/80	-	-	5	5	5	5	4	3	5	3	4	1463	3.3	343	3

Daily Maximum Ozone (pphm)

Date	Rocketdyne	Simi Valley	El Rio	Thousand Oaks	Ojai	Piru	Ventura	Burbank	Reseda	Lennox	West L.A.	Vandenberg AFB 0400 PST Sounding 850 mb Height (msl)	Temp (°C)	Pt. Mugu 1000 PST 3000 ft. winds Dir (°)	Spd (kts)
10/16/80	-	-	6	6	7	6	6	4	6	3	5	1457	4.6	164	5
10/17/80	-	-	7	6	7	7	-	6	7	4	6	1494	5.4	45	5
10/18/80	-	-	5	5	6	4	-	4	5	5	6	1536	9.4	-	-
10/19/80	-	-	5	5	6	4	-	6	4	5	8	1554	14.4	-	-
10/20/80	-	-	6	7	4	6	6	7	8	5	11	1553	15.5	0	0
10/21/80	-	-	6	11	-	4	7	8	8	8	13	1544	16.6	306	1
10/22/80	-	-	9	10	-	-	7	13	12	6	7	1516	15.0	249	1
10/23/80	-	-	7	11	-	-	8	14	14	5	10	1531	17.2	55	7
10/24/80	-	10	8	12	-	-	7	12	10	10	18	1569	16.8	138	6
10/25/80	-	3	5	5	-	-	5	7	9	5	5	1528	14.2	-	-
10/26/80	-	3	5	5	-	-	4	5	6	3	4	1480	7.0	-	-
10/27/80	-	4	5	5	-	-	5	6	3	4	5	1530	10.5	4	8
10/28/80	-	3	5	4	-	-	5	3	3	4	4	1559	12.4	66	28
10/29/80	-	3	5	4	-	-	7	4	3	5	5	1586	13.4	83	9
10/30/80	-	3	6	-	-	-	6	5	4	3	5	1574	17.1	89	2
10/31/80	-	5	6	-	-	-	6	4	6	3	4	1558	16.2	133	12
6/ 1/81	12	13	8	-	10	14	7	12	13	5	8	1468	16.9	105	3
6/ 2/81	9	10	7	-	8	11	6	8	11	6	7	1485	17.6	79	1
6/ 3/81	11	12	8	-	10	14	8	15	18	7	10	1494	15.6	32	17
6/ 4/81	12	6	13	-	13	15	15	19	14	10	13	1504	22.2	63	31
6/ 5/81	20	17	12	-	13	19	9	16	18	9	12	1504	24.6	333	2
6/ 6/81	14	13	9	-	9	13	8	17	16	8	10	1499	22.3	-	-
6/ 7/81	12	11	8	-	11	12	7	17	15	10	10	1512	19.1	-	-
6/ 8/81	13	12	7	-	11	12	6	22	15	9	17	1528	19.9	338	3
6/ 9/81	11	8	5	-	8	10	4	13	12	6	10	1526	20.8	303	16
6/10/81	11	10	6	-	8	10	5	15	18	7	13	1496	19.5	292	1
6/11/81	11	10	7	-	10	10	6	10	11	7	8	1488	16.8	294	14
6/12/81	10	9	7	-	9	10	6	10	11	7	10	1487	12.2	306	6
6/13/81	6	-	6	-	6	8	6	7	5	6	7	1505	11.5	-	-
6/14/81	5	-	5	-	6	7	6	14	5	12	15	1497	13.4	-	-
6/15/81	6	4	5	-	7	8	6	13	4	8	13	1533	19.3	58	34
6/16/81	11	10	9	-	9	11	10	12	12	13	15	1548	23.2	99	9
6/17/81	14	11	10	-	10	13	6	16	14	19	23	1534	22.9	217	3
6/18/81	21	20	16	-	17	18	12	24	17	10	16	1505	22.4	71	10
6/19/81	20	15	9	-	16	16	9	15	13	5	8	1512	23.1	0	0
6/20/81	13	13	10	-	16	-	10	21	18	10	15	1531	24.3	-	-
6/21/81	15	13	7	-	13	-	8	14	12	5	9	1542	23.8	-	-
6/22/81	11	13	5	-	13	-	5	15	19	2	10	1522	24.7	157	1
6/23/81	15	14	-	-	14	-	7	17	19	5	8	1514	24.7	241	3
6/24/81	16	17	6	-	14	-	5	21	14	8	19	1505	24.0	253	3
6/25/81	16	16	6	-	13	-	5	19	17	4	11	1520	21.7	170	5
6/26/81	13	12	6	-	13	-	6	12	13	4	9	1529	23.6	116	4
6/27/81	17	16	7	-	16	-	10	13	13	6	9	1501	23.8	-	-
6/28/81	15	15	7	-	11	14	7	12	12	5	9	1478	21.2	-	-
6/29/81	10	9	5	-	13	18	5	11	11	5	6	1508	21.6	102	4
6/30/81	10	9	5	-	7	13	6	12	12	5	10	1521	23.2	280	10

Daily Maximum Ozone (pphm)

Vandenberg AFB
0400 PST Sounding
850 mb

Pt. Mugu
1000 PST
3000 ft. winds

Date	Rocketdyne	Simi Valley	El Rio	Thousand Oaks	Ojai	Piru	Ventura	Burbank	Reseda	Lennox	West L.A.	Height (msl)	Temp (°C)	Dir (°)	Spd (kts)
7/ 1/81	14	13	6	–	10	12	7	11	11	3	8	1507	21.9	268	4
7/ 2/81	8	8	10	–	10	13	8	18	10	5	12	1495	19.0	118	14
7/ 3/81	6	5	7	–	5	8	6	7	6	4	7	1527	23.1	–	–
7/ 4/81	19	7	11	–	10	13	10	12	13	4	9	1534	25.1	–	–
7/ 5/81	13	9	7	–	11	10	6	11	12	8	9	1535	23.2	–	–
7/ 6/81	13	9	8	–	9	11	11	9	13	4	8	1511	21.2	189	5
7/ 7/81	11	8	11	–	9	11	8	9	10	3	6	1497	20.3	144	4
7/ 8/81	12	6	6	–	9	12	5	8	9	3	5	1507	20.7	120	7
7/ 9/81	8	7	8	–	8	9	8	12	8	4	5	1543	20.4	149	1
7/10/81	11	9	9	–	11	13	9	14	8	5	11	1526	20.3	157	2
7/11/81	12	11	8	–	10	13	6	18	19	10	13	1517	18.6	–	–
7/12/81	15	12	8	–	10	13	6	16	14	13	15	1516	18.9	–	–
7/13/81	16	12	11	–	12	15	6	20	17	10	16	1521	19.7	97	5
7/14/81	16	12	11	–	13	14	11	20	21	5	12	1525	21.8	140	4
7/15/81	16	10	10	–	15	15	8	21	19	6	13	1519	23.0	144	4
7/16/81	13	6	10	–	12	13	6	16	16	5	12	1506	23.2	223	3
7/17/81	14	10	7	–	11	14	6	19	17	8	15	1505	21.4	322	1
7/18/81	12	10	9	–	11	12	6	17	14	8	11	1511	21.0	–	–
7/19/81	13	9	7	–	11	12	6	14	14	8	12	1519	22.5	–	–
7/20/81	13	10	6	–	11	13	6	17	14	5	9	1539	22.1	178	2
7/21/81	15	15	7	–	11	13	5	12	10	4	8	1529	23.7	190	5
7/22/81	14	10	7	–	11	14	7	14	9	3	8	1525	24.4	82	4
7/23/81	16	12	8	–	12	15	6	21	17	9	13	1518	25.1	317	1
7/24/81	13	14	6	–	10	15	5	18	21	8	13	1512	24.0	5	2
7/25/81	17	12	8	–	15	16	7	19	17	10	13	1499	24.3	–	–
7/26/81	13	13	8	–	10	12	7	14	15	5	9	1502	21.6	–	–
7/27/81	11	9	7	–	11	13	7	13	14	5	7	1518	22.3	118	5
7/28/81	12	10	8	–	10	13	7	12	17	5	7	1527	23.1	104	2
7/29/81	12	10	8	–	11	14	7	13	14	5	8	1515	22.5	194	6
7/30/81	14	12	9	–	11	15	6	19	19	7	12	1514	20.9	72	3
7/31/81	13	11	9	–	11	14	6	19	20	9	13	1521	21.1	88	2
8/ 1/81	15	11	–	–	11	14	5	22	22	9	15	1538	20.2	–	–
8/ 2/81	14	12	–	–	11	14	5	17	14	9	13	1532	19.6	–	–
8/ 3/81	12	11	3	–	10	14	4	17	18	7	12	1509	18.1	145	1
8/ 4/81	21	14	9	–	11	15	6	17	22	6	10	1504	19.2	157	2
8/ 5/81	22	11	9	–	13	16	7	22	25	7	13	1518	20.9	–	–
8/ 6/81	24	15	9	–	15	15	7	20	23	8	11	1531	24.8	104	3
8/ 7/81	22	11	8	–	14	15	7	19	19	4	13	1542	26.1	247	7
8/ 8/81	23	12	8	–	15	15	6	15	17	5	9	1519	27.8	–	–
8/ 9/81	22	12	10	–	15	14	6	22	16	7	12	1513	27.6	–	–
8/10/81	18	9	9	–	10	13	7	11	10	3	6	1524	26.6	120	7[B
8/11/81	20	10	–	–	12	13	6	11	11	5	9	1536	23.1	0	0
8/12/81	20	10	–	–	10	11	6	15	14	4	9	1506	21.3	127	6
8/13/81	21	11	6	–	10	12	8	17	16	4	9	1473	20.5	121	8
8/14/81	18	8	6	–	9	10	5	11	9	4	6	1506	21.6	127	11
8/15/81	17	8	6	–	6	8	5	10	13	4	6	1548	21.3	–	–

Daily Maximum Ozone (pphm)

Date	Rocketdyne	Simi Valley	El Rio	Thousand Oaks	Ojai	Piru	Ventura	Burbank	Reseda	Lennox	West L.A.	Vandenberg AFB 0400 PST Sounding 850 mb Height (msl)	Temp (°C)	Pt. Mugu 1000 PST 3000 ft. winds Dir (°)	Spd (kts)
8/16/81	19	9	6	-	10	12	5	11	13	8	8	1550	20.9	-	-
8/17/81	21	11	7	-	9	14	5	10	14	3	6	1512	23.5	123	4
8/18/81	21	11	6	-	13	15	5	9	11	3	6	1485	22.2	118	11
8/19/81	13	11	8	-	10	11	7	14	20	6	10	1508	18.6	113	2
8/20/81	10	10	7	-	10	11	5	24	19	10	19	1515	19.6	219	1
8/21/81	13	9	7	-	10	9	5	15	15	11	17	1504	18.3	135	1
8/22/81	18	13	7	-	11	-	5	22	16	10	17	1499	21.8	-	-
8/23/81	14	11	7	-	9	-	6	16	15	6	8	1504	18.7	-	-
8/24/81	13	9	5	-	9	11	4	14	16	6	12	1489	21.9	160	7
8/25/81	9	8	6	-	6	8	6	14	15	10	15	1507	24.0	142	5
8/26/81	8	5	5	-	11	10	4	16	9	9	12	1525	23.8	291	2
8/27/81	14	10	-	-	13	15	4	16	20	11	22	1507	24.3	327	3
8/28/81	8	7	5	-	9	8	5	23	16	4	13	1478	25.2	182	5
8/29/81	15	11	6	-	12	13	6	15	17	7	9	1476	25.1	-	-
8/30/81	16	11	7	-	11	15	6	13	13	8	10	1486	22.6	-	-
8/31/81	16	12	7	-	12	15	6	12	12	4	7	1468	22.0	-	-
9/ 1/81	15	13	6	-	13	16	9	18	13	4	8	-	-	115	12
9/ 2/81	15	13	9	-	10	16	10	16	11	5	10	1477	20.9	124	8
9/ 3/81	9	12	8	-	11	14	8	12	13	4	8	1477	20.2	129	6
9/ 4/81	10	10	7	-	10	10	7	14	20	5	8	1484	20.4	131	3
9/ 5/81	12	12	-	-	9	7	8	10	11	4	6	1476	21.7	-	-
9/ 6/81	11	11	-	-	10	-	6	13	10	5	8	1484	19.7	-	-
9/ 7/81	11	11	-	-	11	-	6	14	12	6	7	1520	17.5	-	-
9/ 8/81	8	7	6	-	8	-	6	11	2	6	11	1545	19.8	120	1
9/ 9/81	6	5	5	-	7	7	6	12	-	4	12	1544	20.6	270	8
9/10/81	12	11	9	-	9	12	8	11	7	3	8	1515	20.8	125	6
9/11/81	16	15	10	-	12	14	10	16	12	5	13	1525	21.9	106	10
9/12/81	12	10	7	-	9	10	6	17	21	5	11	1539	21.8	-	-
9/13/81	13	12	6	-	8	9	6	13	14	5	9	1543	20.1	-	-
9/14/81	10	10	6	-	9	10	5	13	14	4	8	1535	20.1	-	-
9/15/81	12	11	6	-	11	11	5	16	17	4	7	1522	22.6	128	2
9/16/81	17	16	7	-	12	13	5	23	21	4	7	1540	22.2	305	6
9/17/81	18	12	6	-	10	12	4	27	16	5	12	1542	22.5	27	5
9/18/81	21	23	14	-	20	18	6	15	18	9	17	1556	23.0	0	0
9/19/81	17	17	14	-	14	15	11	16	11	4	16	1544	23.1	114	3
9/20/81	12	12	7	-	12	12	6	13	7	12	13	1523	21.8	-	-
9/21/81	18	15	10	-	12	13	10	16	13	8	14	1513	18.7	85	4
9/22/81	19	16	14	-	11	13	11	13	13	3	9	1503	18.0	90	5
9/23/81	9	9	7	-	9	-	8	9	9	5	6	1509	17.5	119	4
9/24/81	9	9	7	-	8	-	7	12	10	5	8	1522	15.4	267	2
9/25/81	11	11	7	-	10	9	7	13	11	6	10	1532	13.3	295	7
9/26/81	13	13	9	-	9	10	7	15	18	6	7	1526	18.1	-	-
9/27/81	13	13	9	-	11	11	8	17	14	9	9	1521	16.7	-	-
9/28/81	12	10	4	-	8	7	6	12	13	7	9	1512	16.7	-	-
9/29/81	7	7	4	-	6	5	5	4	6	2	3	1485	14.1	143	9
9/30/81	9	8	8	-	7	9	5	6	9	5	6	1482	13.1	66	15

Date	Daily Maximum Ozone (pphm)											Vandenberg AFB 0400 PST Sounding 850 mb		Pt. Mugu 1000 PST 3000 ft. winds	
	Rocketdyne	Simi Valley	El Rio	Thousand Oaks	Ojai	Piru	Ventura	Burbank	Reseda	Lennox	West L.A.	Height (msl)	Temp (°C)	Dir (°)	Spd (kts)
10/ 1/81	5	4	4	-	5	5	4	3	3	2	4	1492	15.1	92	13
10/ 2/81	7	6	5	-	5	5	5	3	5	4	5	1499	12.5	235	5
10/ 3/81	6	5	5	-	4	4	4	5	5	5	4	1470	11.6	-	-
10/ 4/81	8	7	4	-	5	5	4	6	9	3	4	1448	11.3	-	-
10/ 5/81	10	9	7	-	8	6	6	9	12	6	7	1474	10.3	84	3
10/ 6/81	10	10	7	-	9	8	5	7	7	7	12	1513	16.4	125	10
10/ 7/81	10	9	5	-	9	9	4	8	10	3	7	1479	14.2	303	8
10/ 8/81	6	6	5	-	6	5	5	7	7	5	6	1453	10.6	302	7
10/ 9/81	10	5	8	-	10	9	8	8	10	3	5	1474	12.8	0	0
10/10/81	7	-	7	-	9	7	6	5	7	6	5	1487	11.5	-	-
10/11/81	4	-	3	-	4	4	3	3	4	4	3	1459	4.1	-	-
10/12/81	6	-	4	-	5	4	4	4	5	4	4	1460	5.6	-	-
10/13/81	7	-	4	-	6	5	5	4	6	4	5	1456	3.9	109	4
10/14/81	6	-	5	-	7	5	6	5	6	5	5	1503	5.4	314	2
10/15/81	7	-	6	-	6	5	7	6	6	5	6	1505	5.4	39	11
10/16/81	7	-	8	-	6	5	6	5	6	7	7	1533	7.4	315	3
10/17/81	5	-	5	-	7	4	6	7	3	5	6	1554	12.4	-	-
10/18/81	4	-	3	-	6	4	4	7	3	5	5	1571	17.0	-	-
10/19/81	5	-	4	-	5	4	5	5	4	4		1577	17	59	13
10/20/81	10	-	8	-	8	6	6	10	10	4	6	1551	16.7	77	9
10/21/81	12	-	10	-	10	8	9	10	11	7	5	1538	16.8	308	1
10/22/81	12	-	7	-	9	9	6	9	8	6	8	1567	16.3	79	10
10/23/81	6	-	6	-	6	5	6	7	6	2	5	1568	17.8	25	6
10/24/81	10	-	9	-	8	8	5	8	8	-	6	1525	16.0	-	-
10/25/81	15	-	10	-	10	-	7	9	11	-	7	1475	16.5	-	-
10/26/81	6	-	6	-	6	3	3	3	5	5	4	1489	12.3	129	7
10/27/81	7	-	6	-	7	5	3	4	5	3	4	1505	4.5	296	6
10/28/81	3	-	3	-	3	-	3	2	1	2	2	1491	8.1	195	7
10/29/81	4	-	4	-	4	-	3	3	4	3	3	1477	3.8	333	16
10/30/81	4	-	4	-	4	4	4	5	3	2	3	1531	7.1	74	30
10/31/81	4	-	4	-	5	4	4	5	4	2	4	1580	15.4	-	-
6/ 1/82	8	6	6	7	10	8	7	8	7	5	7	1484	9.7	243	2
6/ 2/82	7	7	6	7	8	7	7	6	7	4	5	1476	9.6	224	1
6/ 3/82	9	8	6	7	9	8	7	12	11	5	10	1507	12.1	311	8
6/ 4/82	8	8	6	8	10	7	7	9	10	4	7	1511	12.3	0	0
6/ 5/82	8	-	6	7	10	-	7	7	8	5	7	1485	8.7	-	-
6/ 6/82	9	-	6	8	9	-	8	9	10	5	8	1490	9.8	-	-
6/ 7/82	9	6	5	7	9	-	6	7	8	4	6	1495	10.3	111	4
6/ 8/82	9	11	6	7	8	9	8	7	11	3	5	1499	12.1	81	3
6/ 9/82	11	10	6	7	8	10	7	8	10	3	6	1488	15.8	84	4
6/10/82	8	9	8	7	8	10	8	8	10	4	6	1500	15.0	19	2
6/11/82	11	12	8	10	9	10	8	9	12	4	9	1494	17.5	113	3
6/12/82	10	11	7	8	8	8	7	8	8	5	8	1479	15.2	-	-
6/13/82	9	10	7	7	9	9	6	7	8	4	5	1482	12.2	-	-
6/14/82	10	9	6	7	9	10	7	6	8	3	5	1478	13.8	68	4
6/15/82	9	10	7	7	10	8	8	10	10	3	8	1488	17.7	56	7

Daily Maximum Ozone (pphm)

Date	Rocketdyne	Simi Valley	El Rio	Thousand Oaks	Ojai	Piru	Ventura	Burbank	Reseda	Lennox	West L.A.	Vandenberg AFB 0400 PST Sounding 850 mb		Pt. Mugu 1000 PST 3000 ft. winds	
												Height (msl)	Temp (°C)	Dir (°)	Spd (kts)
6/16/82	-	13	7	8	10	10	7	9	13	4	8	1489	18.8	0	0
6/17/82	8	8	6	6	7	6	5	3	5	3	5	1471	20.9	121	11
6/18/82	4	5	4	5	5	4	5	2	3	2	3	1465	18.6	112	12
6/19/82	10	11	7	8	7	8	6	9	12	3	6	1488	19.2	-	-
6/20/82	8	10	4	7	7	8	6	9	9	5	7	1479	19.3	-	-
6/21/82	10	13	6	6	8	9	6	7	13	4	6	1480	18.3	134	6
6/22/82	10	13	7	8	9	9	7	7	9	4	7	1509	17.8	-	-
6/23/82	9	14	10	8	9	8	7	9	9	4	7	1514	17.6	237	1
6/24/82	11	11	6	8	10	8	5	11	12	3	7	1505	13.6	237	1
6/25/82	13	11	6	6	10	7	7	15	17	8	11	1505	13.6	314	3
6/26/82	15	14	6	9	10	9	3	19	18	4	8	1521	15.7	293	6
6/27/82	10	11	7	9	8	8	3	14	13	5	12	1512	16.0	-	-
6/28/82	5	8	4	6	6	6	3	7	6	4	7	1477	14.7	173	5
6/29/82	6	9	4	6	5	4	3	2	5	2	3	1445	10.7	97	5
6/30/82	4	8	5	4	6	4	3	2	3	2	3	1448	6.9	237	4
7/ 1/82	9	8	7	9	7	7	4	8	11	3	5	1487	12.1	0	0
7/ 2/82	14	14	8	13	10	9	6	11	11	5	6	1516	16.2	117	5
7/ 3/82	14	13	9	12	-	8	7	11	8	8	11	1527	17.0	48	2
7/ 4/82	12	10	7	11	-	7	6	12	11	7	10	1512	13.9	-	-
7/ 5/82	9	8	8	10	-	7	5	9	10	3	6	1495	14.0	-	-
7/ 6/82	10	9	8	10	10	9	5	10	6	4	7	1494	15.6	104	10
7/ 7/82	13	13	7	8	11	11	8	12	9	4	10	1506	15.6	138	7
7/ 8/82	12	12	8	10	11	9	8	11	8	5	8	1514	15.9	152	3
7/ 9/82	13	13	9	11	13	10	5	15	19	4	8	1520	17.9	171	6
7/10/82	14	13	10	12	14	13	9	18	19	12	11	1527	18.7	-	-
7/11/82	13	12	8	12	13	11	12	17	16	-	13	1512	20.2	-	-
7/12/82	18	17	11	14	15	15	10	20	17	5	10	1518	20.6	141	3
7/13/82	13	11	8	9	11	12	8	22	17	6	12	1526	22.1	206	2
7/14/82	17	15	9	11	13	13	8	20	14	7	10	1506	22.6	283	1
7/15/82	19	17	9	9	14	12	12	13	13	3	6	1473	21.9	143	9
7/16/82	14	13	9	11	12	12	7	10	11	5	8	1488	19.9	92	6
7/17/82	14	14	8	12	10	11	7	16	14	8	11	1491	17.6	-	-
7/18/82	12	11	5	9	8	9	5	15	14	7	10	1499	18.6	-	-
7/19/82	10	10	6	8	11	9	5	19	16	6	10	1516	21.5	279	7
7/20/82	12	11	5	9	11	2	5	18	13	5	10	1527	23.1	314	20
7/21/82	19	17	7	12	14	-	5	21	16	4	11	1532	22.8	179	1
7/22/82	17	15	7	12	14	13	5	23	20	3	14	1536	23.3	290	2
7/23/82	20	16	7	11	16	13	5	19	17	4	10	1522	22.2	136	5
7/24/82	16	13	6	10	14	13	5-	14	14	4	10	1509	21.8	-	-
7/25/82	14	14	6	9	11	12	5	12	14	5	7	1517	21.6	-	-
7/26/82	14	13	5	9	12	12	5	15	19	4	9	1526	20.7	106	5
7/27/82	13	13	6	8	12	11	6	12-	10	3	7	1539	20.5	101	4
7/28/82	8	8	5	7	9	9	5	9	10	3	5	1565	21.1	273	3
7/29/82	15	16	7	9	14	12	5	15	14	2	6	1543	25.0	0	0
7/30/82	20	22	6	10	15	13	5	17	14	4	6	1541	27.4	157	4
7/31/82	18	18	9	12	15	14	8	15	13	4	12	1561	26.7	-	-

Daily Maximum Ozone (pphm)

Vandenberg AFB
0400 PST Sounding
850 mb

Pt. Mugu
1000 PST
3000 ft. winds

Date	Rocketdyne	Simi Valley	El Rio	Thousand Oaks	Ojai	Piru	Ventura	Burbank	Reseda	Lennox	West L.A.	Height (msl)	Temp (°C)	Dir (°)	Spd (kts)
8/ 1/82	16	17	7	11	11	11	7	16	15	6	10	1533	25.7	-	-
8/ 2/82	10	12	6	7	11	11	5	12	13	5	10	1489	21.0	234	2
8/ 3/82	12	14	5	7	9	8	6	11	10	5	8	1493	17.8	70	1
8/ 4/82	13	14	6	4	11	9	5	18	10	10	11	1512	17.9	314	1
8/ 5/82	11	12	8	10	11	10	7	22	17	5	11	1536	20.2	101	2
8/ 6/82	21	23	8	15	15	11	5	20	20	7	15	1552	23.8	155	1
8/ 7/82	18	18	5	15	19	15	5	17	14	5	8	1548	23.8	-	-
8/ 8/82	12	13	6	9	11	9	6	18	17	5	11	1557	24.0	-	-
8/ 9/82	9	10	5	6	8	7	4	16	14	4	14	1526	21.8	295	5
8/10/82	14	14	4	10	12	10	4	17	10	5	11	1512	21.3	260	3
8/11/82	16	16	8	11	13	12	8	12	11	6	8	1508	20.0	73	6
8/12/82	13	16	7	9	9	10	4	11	12	4	8	1503	19.4	103	4
8/13/82	11	14	6	7	9	9	5	11	12	4	8	1513	18.8	118	5
8/14/82	12	14	6	7	8	10	5	13	10	5	9	1510	18.2	-	-
8/15/82	12	13	7	7	10	9	7	12	9	4	7	1518	18.8	-	-
8/16/82	14	15	7	9	11	10	8	16	12	6	9	1532	19.0	103	6
8/17/82	12	13	8	10	12	12	9	17	13	5	12	1531	21.2	127	6
8/18/82	13	14	5	9	10	-	5	18	17	6	10	1515	20.1	0	0
8/19/82	12	12	5	8	10	-	4	16	16	5	9	1516	22.3	127	6
8/20/82	11	11	5	8	9	-	4	14	15	5	10	1541	22.3	90	1
8/21/82	13	15	5	10	12	-	3	12	9	8	12	1560	24.4	-	-
8/22/82	16	16	6	10	16	-	3	13	10	4	6	1539	26.3	-	-
8/23/82	18	18	6	8	14	7	8	12	11	5	8	1535	24.9	223	3
8/24/82	9	12	5	7	9	8	3	7	13	4	5	1528	22.8	86	3
8/25/82	11	12	5	8	9	10	3	13	11	4	8	1521	24.7	50	5
8/26/82	14	16	6	10	12	11	4	13	11	9	11	1509	22.8	148	3
8/27/82	10	12	7	7	10	10	4	13	10	3	5	1524	21.9	123	2
8/28/82	13	15	5	8	9	11	3	12	9	5	6	1523	19.5	-	-
8/29/82	9	10	7	8	9	8	5	11	9	6	7	1521	16.4	-	-
8/30/82	9	13	5	7	9	9	3	12	11	5	8	1522	17.6	158	5
8/31/82	13	13	7	9	11	9	4	16	17	5	11	1523	19.1	137	2
9/ 1/82	7	9	6	7	9	10	3	18	10	6	17	1544	22.6	295	8
9/ 2/82	16	13	7	13	10	8	4	25	13	11	28	1558	26.8	61	4
9/ 3/82	17	6	10	12	12	11	4	22	21	16	22	1538	24.1	239	2
9/ 4/82	18	-	6	11	9	9	2	22	22	8	18	1537	21.2	-	-
9/ 5/82	19	-	11	14	15	14	5	19	13	9	19	1515	22.6	-	-
9/ 6/82	16	-	7	12	13	12	5	16	17	9	11	1531	22.8	-	-
9/ 7/82	14	-	7	11	10	12	5	21	14	8	12	1503	23.3	114	8
9/ 8/82	12	-	7	8	10	9	6	3	4	1	2	1507	22.6	118	15
9/ 9/82	14	-	6	9	11	11	6	13	9	5	9	1531	18.0	118	15
9/10/82	10	-	5	5	7	8	4	6	11	3	4	1497	19.3	104	6
9/11/82	9	-	8	8	8	9	6	9	8	6	8	1484	15.9	269	6
9/12/82	9	-	6	7	8	9	5	8	7	5	6	1490	18.5	-	-
9/13/82	11	-	6	9	8	11	4	6	7	3	5	1475	16.8	-	-
9/14/82	7	-	5	6	6	7	3	4	5	3	4	1489	12.8	104	8
9/15/82	4	-	4	3	3	5	3	3	2	1	2	1471	7.9	120	13

Daily Maximum Ozone (pphm)

Date	Rocketdyne	Simi Valley	El Rio	Thousand Oaks	Ojai	Piru	Ventura	Burbank	Reseda	Lennox	West L.A.	Vandenberg AFB 0400 PST Sounding 850 mb Height (msl)	Temp (°C)	Pt. Mugu 1000 PST 3000 ft. winds Dir (°)	Spd (kts)
9/16/82	5	-	5	4	4	4	2	3	3	1	3	1465	7.7	167	16
9/17/82	9	7	6	8	7	7	2	8	11	4	8	1487	6.4	132	9
9/18/82	6	5	5	6	5	5	4	6	3	4	5	1499	10.7	-	-
9/19/82	6	5	5	5	5	5	4	8	6	3	4	1487	13.2	-	-
9/20/82	10	8	8	9	8	8	9	12	11	7	9	1486	13.6	109	7
9/21/82	12	11	8	9	11	12	8	19	14	7	10	1490	17.8	93	6
9/22/82	14	13	8	10	9	10	7	21	12	5	11	1506	20.1	136	2
9/23/82	14	12	7	12	13	12	6	16	16	8	22	1527	22.4	122	12
9/24/82	10	8	11	9	9	7	10	11	9	11	15	1516	17.1	145	7
9/25/82	3	2	9	3	3	3	7	3	1	1	1	1505	17.3	-	-
9/26/82	3	2	4	4	5	4	3	2	1	2	3	1474	14.5	-	-
9/27/82	6	6	4	5	5	6	4	4	4	3	4	1444	8.7	321	7
9/28/82	8	6	8	7	7	7	7	6	6	4	5	1457	9.9	155	4
9/29/82	6	4	6	5	7	6	5	5	4	3	4	1448	12.4	164	6
9/30/82	7	5	5	5	7	5	5	7	5	0	6	1449	9.2	313	2
10/ 1/82	10	10	10	8	10	7	9	9	8	7	9	1498	11.1	91	3
10/ 2/82	10	9	7	8	9	7	6	11	8	9	9	1521	16.6	-	-
10/ 3/82	14	13	10	10	13	9	7	12	11	8	10	1496	16.5	-	-
10/ 4/82	13	12	8	10	10	9	6	11	13	5	10	1476	14.5	281	2
10/ 5/82	11	11	9	9	10	8	8	11	10	7	10	1475	11.0	50	29
10/ 6/82	12	11	6	10	9	7	5	15	9	6	10	1500	16.3	90	7
10/ 7/82	9	9	6	6	6	8	8	9	7	5	9	1482	9.7	18	5
10/ 8/82	5	6	5	4	7	4	5	9	4	7	14	1518	13.5	72	12
10/ 9/82	5	4	5	3	7	4	4	7	3	6	7	1538	17.5	-	-
10/10/82	6	4	5	4	6	4	3	6	4	5	6	1538	13.5	-	-
10/11/82	8	5	5	5	7	5	6	5	4	3	5	1538	14.2	-	-
10/12/82	9	7	10	8	8	4	8	7	5	5	13	1527	16.5	0	0
10/13/82	8	6	7	6	9	4	8	6	5	6	5	1545	16.1	140	10
10/14/82	11	10	3	11	9	7	6	10	6	6	10	1541	16.5	92	10
10/15/82	12	11	3	9	6	7	8	8	8	8	10	1544	16.6	76	4
10/16/82	13	11	3	11	6	8	7	13	9	11	15	1542	17.3	-	-
10/17/82	15	15	3	11	5	8	7	18	16	9	15	1537	14.2	-	-
10/18/82	10	14	5	12	6	12	12	9	12	7	11	1510	16.8	-	-
10/19/82	13	13	3	10	5	9	6	10	11	4	6	1519	14.4	298	3
10/20/82	8	8	2	4	2	7	5	9	9	4	8	1539	10.5	347	9
10/21/82	8	8	7	7	8	5	6	11	11	4	7	1539	12.6	299	14
10/22/82	5	4	5	3	5	2	5	11	1	6	8	1567	17.5	325	3
10/23/82	4	4	3	3	4	3	3	3	3	2	5	1556	16.6	309	13
10/24/82	3	3	2	3	4	3	2	6	4	1	3	1539	12.2	-	-
10/25/82	3	3	1	2	3	1	1	2	2	1	0	1534	12.1	298	12
10/26/82	4	4	4	3	5	3	4	3	3	3	3	1507	9.2	277	16
10/27/82	4	4	4	4	6	4	5	5	3	3	4	1535	6.7	51	26
10/28/82	4	4	4	4	6	4	5	5	5	4	6	1533	10.2	87	13
10/29/82	6	6	5	5	7	4	6	6	7	4	8	1520	16.0	296	5
10/30/82	4	3	4	4	4	3	3	3	2	1	2	1472	12.3	-	-
10/31/82	6	6	5	6	6	4	5	7	6	5	7	1484	6.5	-	-

Daily Maximum Ozone (pphm)

Date	Rocketdyne	Simi Valley	El Rio	Thousand Oaks	Ojai	Piru	Ventura	Burbank	Reseda	Lennox	West L.A.	Vandenberg AFB 0400 PST Sounding 850 mb		Pt. Mugu 1000 PST 3000 ft. winds	
												Height (msl)	Temp (°C)	Dir (°)	Spd (kts)
6/ 1/83	5	5	4	4	4	4	4	3	5	4	4	-	-	179	5
6/ 2/83	5	5	4	4	5	3	4	3	5	4	4	-	-	97	4
6/ 3/83	8	8	4	5	7	5	7	6	5	4	4	-	-	139	6
6/ 4/83	9	9	6	7	8	5	5	10	9	5	7	-	-	-	-
6/ 5/83	10	9	7	8	9	6	5	13	14	7	9	-	-	-	-
6/ 6/83	11	11	7	9	10	7	9	18	22	7	15	-	-	327	2
6/ 7/83	13	10	7	7	8	8	7	12	14	6	9	-	-	283	5
6/ 8/83	7	7	4	6	7	3	7	8	10	6	6	-	-	207	1
6/ 9/83	9	8	6	7	8	5	5	8	9	5	6	-	-	78	3
6/10/83	11	11	7	8	10	7	11	12	13	6	7	-	-	225	2
6/11/83	7	7	-	7	7	4	7	8	9	6	7	-	-	-	-
6/12/83	8	8	-	7	7	5	8	9	7	5	7	-	-	-	-
6/13/83	9	8	7	8	11	7	8	13	16	6	6	-	-	64	24
6/14/83	14	13	8	12	10	10	8	18	14	10	9	-	-	29	6
6/15/83	15	14	10	12	13	12	11	19	18	10	10	-	-	196	3
6/16/83	19	16	10	14	12	13	12	16	13	5	8	-	-	105	6
6/17/83	14	12	10	10	12	8	10	17	16	7	8	-	-	196	2
6/18/83	12	11	8	10	11	9	10	15	15	8	10	-	-	-	-
6/19/83	13	10	8	8	10	8	9	12	12	8	8	-	-	-	-
6/20/83	12	10	7	7	9	7	9	10	13	7	7	-	-	0	0
6/21/83	12	12	7	9	10	8	9	11	13	6	7	-	-	94	11
6/22/83	11	12	8	10	11	10	9	16	12	6	8	-	-	106	9
6/23/83	13	12	7	9	10	8	9	10	12	5	7	-	-	56	4
6/24/83	10	9	6	7	9	7	9	13	10	7	9	-	-	118	2
6/25/83	9	11	6	7	8	8	12	12	15	6	8	-	-	-	-
6/26/83	10	11	6	8	8	6	7	7	8	6	5	-	-	-	-
6/27/83	8	7	5	5	7	5	6	6	6	5	5	-	-	278	2
6/28/83	8	8	5	5	6	6	6	9	11	4	6	-	-	55	2
6/29/83	11	11	6	8	5	8	9	9	8	5	7	-	-	338	1
6/30/83	8	8	6	7	9	6	7	7	8	4	7	-	-	103	3
7/ 1/83	11	11	6	9	10	8	7	10	10	5	7	1492	14.4	323	2
7/ 2/83	10	9	6	8	6	8	6	8	10	5	6	1507	14.3	-	-
7/ 3/83	8	8	6	6	7	6	8	13	13	7	9	1498	15.7	-	-
7/ 4/83	12	11	7	10	8	8	6	13	11	6	6	1509	18.0	-	-
7/ 5/83	15	14	9	10	-	10	7	16	11	5	8	1514	20.4	126	9
7/ 6/83	13	11	6	9	-	7	7	13	13	5	5	1491	12.4	88	7
7/ 7/83	14	12	6	10	10	8	10	13	11	4	7	1498	16.6	26	2
7/ 8/83	13	11	6	8	10	7	7	7	8	5	10	1508	16.2	210	2
7/ 9/83	12	10	7	8	10	7	7	18	14	9	11	1526	13.6	-	-
7/10/83	11	9	8	9	10	7	5	20	10	12	14	1530	17.2	-	-
7/11/83	18	15	13	12	15	13	13	21	13	9	16	1524	22.9	76	6
7/12/83	16	14	9	12	12	14	9	31	24	6	11	1527	23.0	351	3
7/13/83	16	13	10	13	11	13	7	24	26	7	13	1538	24.5	225	3
7/14/83	19	15	8	10	17	13	8	19	18	4	10	1520	24.3	285	6
7/15/83	10	11	6	7	10	8	8	9	11	5	5	1488	20.3	308	5
7/16/83	8	8	6	6	-	6	7	11	9	6	7	1457	18.9	-	-

Daily Maximum Ozone (pphm)

Date	Rocketdyne	Simi Valley	El Rio	Thousand Oaks	Ojai	Piru	Ventura	Burbank	Reseda	Lennox	West L.A.	Vandenberg AFB 0400 PST Sounding 850 mb Height (msl)	Temp (°C)	Pt. Mugu 1000 PST 3000 ft. winds Dir (°)	Spd (kts)
7/17/83	13	11	7	8	-	8	4	11	11	6	7	1459	16.3	-	-
7/18/83	12	12	6	8	-	8	5	15	11	8	11	1468	14.4	0	0
7/19/83	12	11	5	8	11	8	6	14	10	10	23	1496	14.6	211	2
7/20/83	13	11	5	11	10	9	8	21	14	16	16	1516	16.2	71	3
7/21/83	16	13	4	11	12	10	6	14	9	6	8	1517	19.6	124	4
7/22/83	15	12	6	8	8	8	7	17	12	8	10	1513	19.1	0	0
7/23/83	16	13	5	9	9	10	7	21	13	7	10	1516	19.7	-	-
7/24/83	15	13	7	10	8	10	8	14	13	7	11	1504	19.1	-	-
7/25/83	13	12	9	10	8	12	10	10	10	7	8	1507	16.7	123	6
7/26/83	14	13	6	10	7	8	6	15	13	8	12	1505	14.5	92	3
7/27/83	16	12	8	12	10	11	8	11	12	5	7	1495	14.8	95	8
7/28/83	12	11	9	12	10	11	12	13	9	5	8	1519	16.6	97	13
7/29/83	15	13	8	11	12	12	8	18	12	7	8	1536	17.6	101	9
7/30/83	15	14	1	10	10	11	8	19	18	8	7	1531	21.3	-	-
7/31/83	15	14	1	9	11	10	6	16	16	6	9	1527	23.0	-	-
8/ 1/83	17	13	4	11	12	12	8	21	15	8	11	1522	21.8	106	9
8/ 2/83	17	15	6	11	12	13	9	21	17	6	11	1532	21.1	132	3
8/ 3/83	14	13	7	9	11	11	9	21	13	5	8	1534	20.4	5	1
8/ 4/83	13	12	8	8	9	11	8	23	16	6	10	1540	20.7	260	0
8/ 5/83	14	10	6	9	9	11	7	25	16	9	13	1554	23.9	38	1
8/ 6/83	13	11	13	9	11	10	16	15	12	12	13	1550	26.4	-	-
8/ 7/83	13	10	5	10	10	9	7	19	12	13	15	1545	23.2	-	-
8/ 8/83	15	13	4	8	12	11	7	20	14	2	8	1532	23.0	291	6
8/ 9/83	11	9	5	9	12	11	11	14	12	8	15	1515	22.0	124	14
8/10/83	13	13	7	11	12	13	6	16	11	4	6	1513	18.2	121	14
8/11/83	12	11	8	9	13	10	8	12	7	3	6	1524	19.3	99	12
8/12/83	14	11	7	10	9	9	7	12	12	7	13	1533	21.2	112	8
8/13/83	9	7	5	8	8	6	6	17	6	5	13	1519	19.9	-	-
8/14/83	6	6	3	6	6	5	6	14	8	6	12	1527	22.0	-	-
8/15/83	14	11	8	12	12	11	7	26	21	8	22	1514	21.7	104	10
8/16/83	18	16	8	14	11	11	7	24	15	4	13	1530	21.8	64	5
8/17/83	14	12	9	13	10	12	8	23	16	5	16	1514	21.7	114	4
8/18/83	3	2	2	3	3	2	5	2	1	1	2	1505	15.7	132	14
8/19/83	3	2	3	3	3	2	4	1	2	2	2	1504	13.0	151	6
8/20/83	5	4	3	5	5	4	5	3	3	3	3	1515	7.4	-	-
8/21/83	5	5	2	5	5	5	5	7	6	3	4	1515	9.4	-	-
8/22/83	10	9	6	7	7	8	6	10	10	5	7	1517	12.0	151	3
8/23/83	10	9	4	10	7	8	7	15	12	9	7	1516	14.0	225	0
8/24/83	13	12	5	7	8	10	7	15	12	5	10	1508	14.4	106	5
8/25/83	14	12	6	10	10	10	2	17	14	7	13	1537	16.2	109	4
8/26/83	13	11	7	11	12	10	7	19	12	13	16	1539	19.9	0	0
8/27/83	15	13	7	14	10	10	9	25	16	16	20	1531	20.7	-	-
8/28/83	14	15	9	13	10	11	5	24	16	11	22	1535	20.6	-	-
8/29/83	11	8	6	11	8	10	8	19	10	9	16	1522	20.1	232	2
8/30/83	10	9	5	9	8	8	7	21	25	8	14	1515	20.9	183	2
8/31/83	7	6	5	7	6	8	4	12	6	3	7	1513	18.5	295	4

Daily Maximum Ozone (pphm)

Date	Rocketdyne	Simi Valley	El Rio	Thousand Oaks	Ojai	Piru	Ventura	Burbank	Reseda	Lennox	West L.A.	Vandenberg AFB 0400 PST Sounding 850 mb Height (msl)	Temp (°C)	Pt. Mugu 1000 PST 3000 ft. winds Dir (°)	Spd (kts)
9/ 1/83	6	6	4	6	8	6	7	18	9	4	9	1523	18.3	-	-
9/ 2/83	9	9	5	8	8	8	9	22	24	6	16	1515	21.4	273	3
9/ 3/83	15	13	5	11	11	12	6	19	14	8	13	1499	21.8	-	-
9/ 4/83	14	11	7	12	9	11	4	20	13	6	10	1556	18.1	-	-
9/ 5/83	16	12	9	11	10	11	-	22	18	11	15	1550	21.4	-	-
9/ 6/83	17	15	7	13	12	13	9	27	13	7	9	1478	23.0	128	8
9/ 7/83	15	14	5	9	10	10	6	13	16	5	12	1481	21.7	128	7
9/ 8/83	10	10	5	9	7	7	5	14	11	4	7	1480	18.4	152	4
9/ 9/83	7	6	6	8	7	7	6	15	7	7	14	1496	19.8	158	2
9/10/83	14	11	12	15	11	11	8	19	17	14	23	1515	23.5	-	-
9/11/83	11	10	14	12	8	11	10	20	13	18	19	1527	24.5	-	-
9/12/83	28	23	7	18	14	17	15	15	20	7	11	1525	25.5	132	4
9/13/83	18	16	13	13	12	15	13	22	20	8	14	1530	25.6	120	3
9/14/83	19	15	10	12	15	14	12	25	18	6	16	1521	24.6	235	3
9/15/83	17	15	8	10	12	13	10	28	9	7	11	1524	25.6	128	3
9/16/83	14	15	7	9	9	12	9	28	16	6	12	1521	24.4	88	4
9/17/83	18	17	8	12	13	14	5	23	16	10	19	1516	22.8	-	-
9/18/83	14	15	7	10	10	12	4	22	19	12	20	1503	22.1	117	5
9/19/83	13	12	10	10	12	11	14	11	12	4	11	1494	22.5	120	21
9/20/83	9	10	5	6	6	6	6	5	8	2	3	1515	21.2	78	15
9/21/83	5	7	2	3	5	5	5	10	10	3	5	-	-	117	12
9/22/83	7	7	3	4	5	4	5	7	9	3	4	1514	14.8	167	2
9/23/83	7	8	6	6	6	6	6	9	10	4	6	1521	13.4	113	2
9/24/83	11	11	7	9	8	9	-	8	11	4	6	1518	13.2	-	-
9/25/83	10	10	7	8	8	8	-	14	10	5	11	1525	13.7	111	9
9/26/83	5	7	5	5	5	5	5	5	4	4	4	1518	7.9	231	4
9/27/83	8	9	6	8	6	7	7	5	7	3	5	1508	10.3	113	9
9/28/83	5	6	4	5	5	5	8	3	4	3	4	1470	10.2	128	8
9/29/83	3	6	5	4	4	4	6	3	3	3	3	1454	8.8	223	6
9/30/83	3	3	3	4	3	3	5	2	1	1	1	1409	6.3	184	10
10/ 1/83	4	6	4	5	4	3	5	4	5	3	3	1539	14.3	-	-
10/ 2/83	6	7	4	5	4	4	5	7	5	4	5	1493	8.1	-	-
10/ 3/83	9	9	6	9	7	7	7	11	7	8	12	1498	10.6	69	17
10/ 4/83	14	15	6	11	8	6	7	16	11	4	7	1512	15.3	63	17
10/ 5/83	7	8	5	6	6	5	7	5	8	3	4	1511	13.5	104	5
10/ 6/83	11	9	5	10	7	5	7	13	13	10	11	1539	14.3	100	9
10/ 7/83	-	6	5	6	5	5	6	11	8	4	6	1512	13.5	-	-
10/ 8/83	-	4	5	5	3	3	6	4	2	4	3	1514	14.1	-	-
10/ 9/83	-	6	4	5	5	4	6	7	4	4	4	1517	9.4	-	-
10/10/83	-	6	4	7	8	5	7	0	9	6	7	1536	9.6	-	-
10/11/83	-	6	4	5	6	4	8	18	3	8	19	1547	19.6	-	-
10/12/83	-	7	4	7	7	5	8	10	6	4	8	1564	23.0	-	-
10/13/83	-	11	5	9	8	8	8	12	12	7	11	1510	16.0	-	-
10/14/83	-	12	9	12	7	7	9	6	8	6	6	1471	10.1	-	-
10/15/83	-	10	7	9	8	7	8	6	7	4	5	1480	9.7	-	-
10/16/83	-	9	6	8	7	7	6	10	9	8	11	1498	10.0	-	-

Date	Rocketdyne	Simi Valley	El Rio	Thousand Oaks	Ojai	Piru	Ventura	Burbank	Reseda	Lennox	West L.A.	Vandenberg AFB 0400 PST Sounding 850 mb Height (msl)	Temp (°C)	Pt. Mugu 1000 PST 3000 ft. winds Dir (°)	Spd (kts)
					Daily Maximum Ozone (pphm)										
10/17/83	-	9	5	7	7	6	9	4	5	4	1	1490	11.2	-	-
10/18/83	-	9	6	9	8	7	9	16	15	10	13	1496	15.4	-	-
10/19/83	-	18	15	18	8	15	9	19	20	1	17	1490	16.6	-	-
10/20/83	-	21	8	19	13	19	11	14	16	5	9	1488	17.2	-	-
10/21/83	-	13	9	14	9	9	12	9	11	9	10	1518	15.6	-	-
10/22/83	-	7	8	7	5	5	9	7	6	14	19	1541	16.4	-	-
10/23/83	-	11	6	10	11	8	7	15	11	8	10	1524	16.9	-	-
10/24/83	-	4	5	4	6	3	8	8	3	5	7	1518	12.5	-	-
10/25/83	-	4	3	5	6	4	7	8	3	5	11	1561	16.4	-	-
10/26/83	-	5	2	5	4	4	8	6	7	5	9	1553	17.1	-	-
10/27/83	-	9	14	9	14	10	17	8	9	7	11	1518	17.0	-	-
10/28/83	-	13	9	10	11	11	13	14	15	5	11	1536	16.1	-	-
10/29/83	-	7	5	6	6	8	7	7	8	5	7	1543	13.8	-	-
10/30/83	-	4	4	3	4	3	6	2	3	3	3	1525	9.8	-	-
10/31/83	-	3	3	3	3	2	5	2	2	1	2	1519	10.0	-	-

APPENDIX C

AMBIENT HYDROCARBON DATA ANALYSIS

APPENDIX C

Ambient Hydrocarbon Data Analysis

Ozone formation is strongly influenced by the amount and speciation of ambient hydrocarbons. Theoretical models and ambient measurements show strong correlation between ozone concentrations and hydrocarbon concentrations. Measurements made in urban areas over the last two decades have shown that the nonmethane hydrocarbon (NMHC) concentrations have large day-to-day variability like other pollutant concentrations; however, the relative amount of different species in the NMHCs is fairly constant and similar in most urban areas.

Ambient NMHC data collected by CARB during the 1980 SANBOX study were analyzed to investigate the NMHC speciation in Ventura and Santa Barbara Counties. The 1980 data base was selected because it is the only one that has a significant number of samples (200 between September 2 and October 6) and accurate speciation information in the study area. The analysis was exploratory and intended to provide preliminary answers to the following questions:

1) What is the average NMHC speciation at stations in the study area?

2) Is there significant variability in NMHC speciation between stations, or is the speciation similar at most stations?

3) Are the NMHC concentration and speciation significantly different on days with high and low ozone concentrations?

4) Is the speciation similar to observations in other urban areas?

The hydrocarbon samples were collected in canisters for three-hour intervals and subsequently analyzed by gas chromatography at CARB's El Monte laboratory. The samples were primarily collected between 6:00 and 9:00 a.m.; however, some additional samples were collected between 9:00 and 12:00 a.m. and 12:00 and 3:00 p.m. C2 through C10 hydrocarbons were analyzed; however, the speciation above C5 was very limited. Approximately 20 species or groups of species were reported in the CARB analysis, which is far fewer than the normal 50 to 200 species reported

in GC analysis of ambient NMHC. The data were combined into the following six groups for display purposes:

- ethane (C2H6)
- acetylene (C2H2)
- >C2 alkanes
- ethylene (C2H4)
- >C2 alkenes
- aromatics

Ethane and acetylene are very slowly reacting compounds that do not contribute significantly to hydrocarbon oxidation of NO_x. Acetylene is reported separately here because it is a tracer for automobile exhaust. The greater than C2 alkanes, ethylene, >C2 alkenes, and aromatic compounds are reactive compound which contribute to ozone formation. Most of the available computer models distinguish the roles of these four different types of hydrocarbons.

The location of the measurement stations are shown in Figure C-1. The map shows that three stations are in Ventura County, four are in Santa Barbara County, and one is on the border. The total NMHC concentrations and speciation on the six-class system are shown in Figures C-2 through C-11 for the eight stations. Table C-1 lists the minimum, mean, and maximum NMHC concentrations observed in the study period by station. These show considerable day-to-day and station-to-station variability in NMHC concentrations.

The data from Pt. Conception and Gaviota Pass show much lower concentrations than the other stations due to their greater distance from the population centers and dominant emission sources. These more remote stations have average NMHC concentrations of 0.22 to 0.26 ppmC. The data from the other six stations show average concentrations of 0.64 to 0.93 ppmC, and maximum concentrations of 1.5 to 2.0 (when the El Rio outlier is ignored). These average and maximum concentrations are similar to ambient concentrations in many moderately populated regions of the country.

Figure C-12 shows the average normalized speciation of the ambient NMHCs in the area. The data show the average mixtures contain 58 to 72%
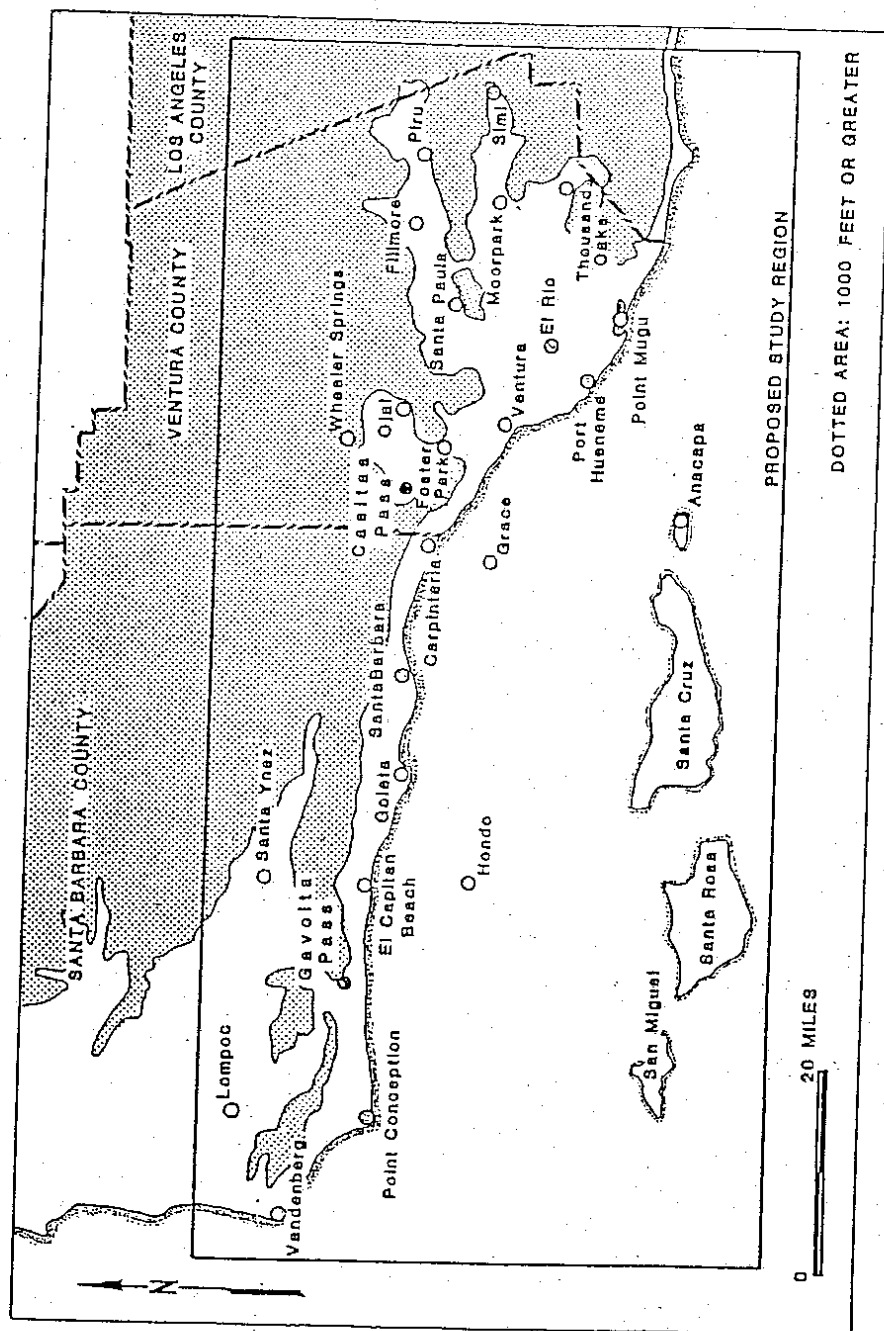
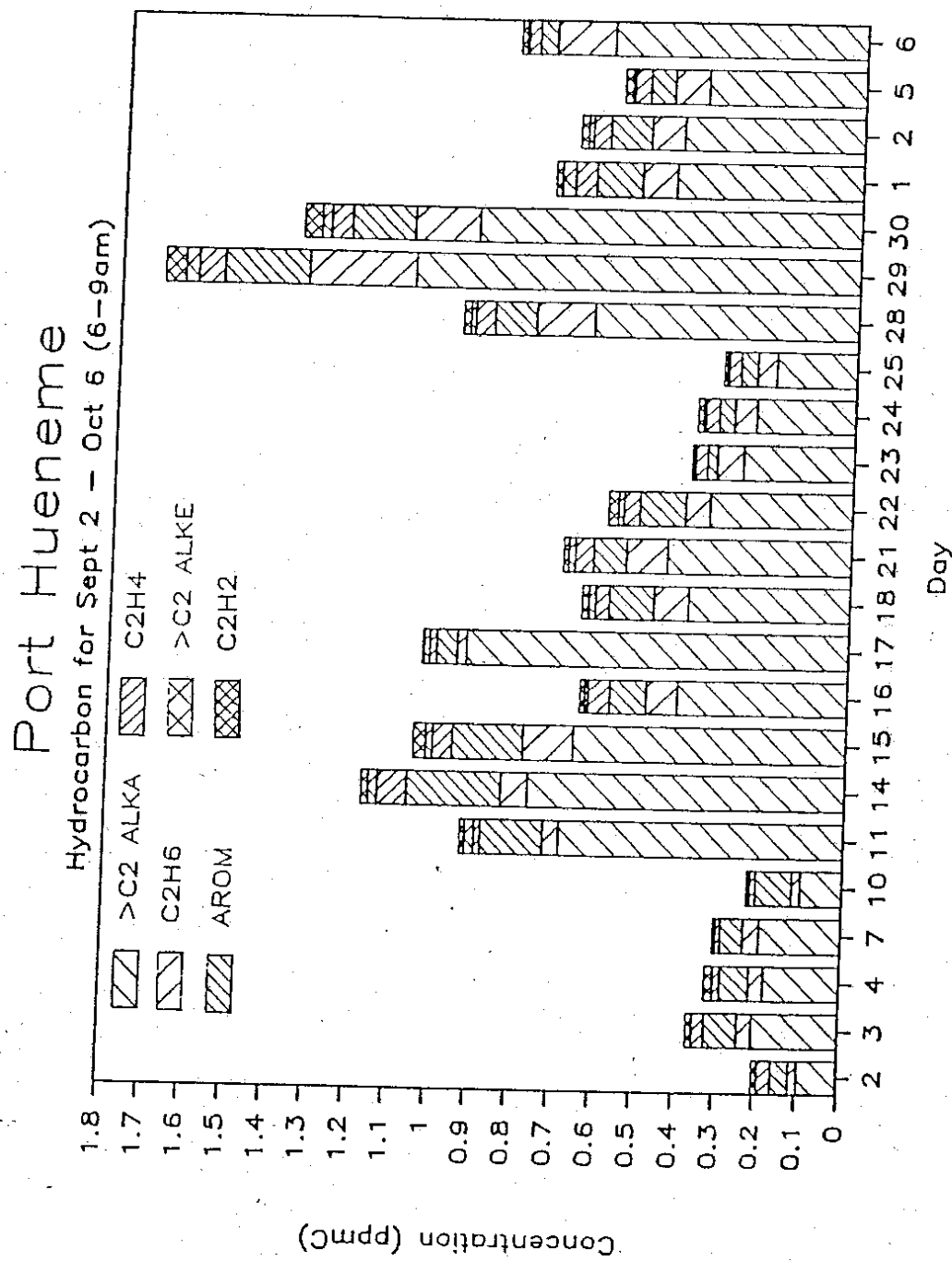Figure C-1. NMIC Monitoring Sites (solid circles) in the 1980 SANBOX study.

Figure C-2. NMHC Concentrations Observed at Port Hueneme in the 1980 SANBOX Study
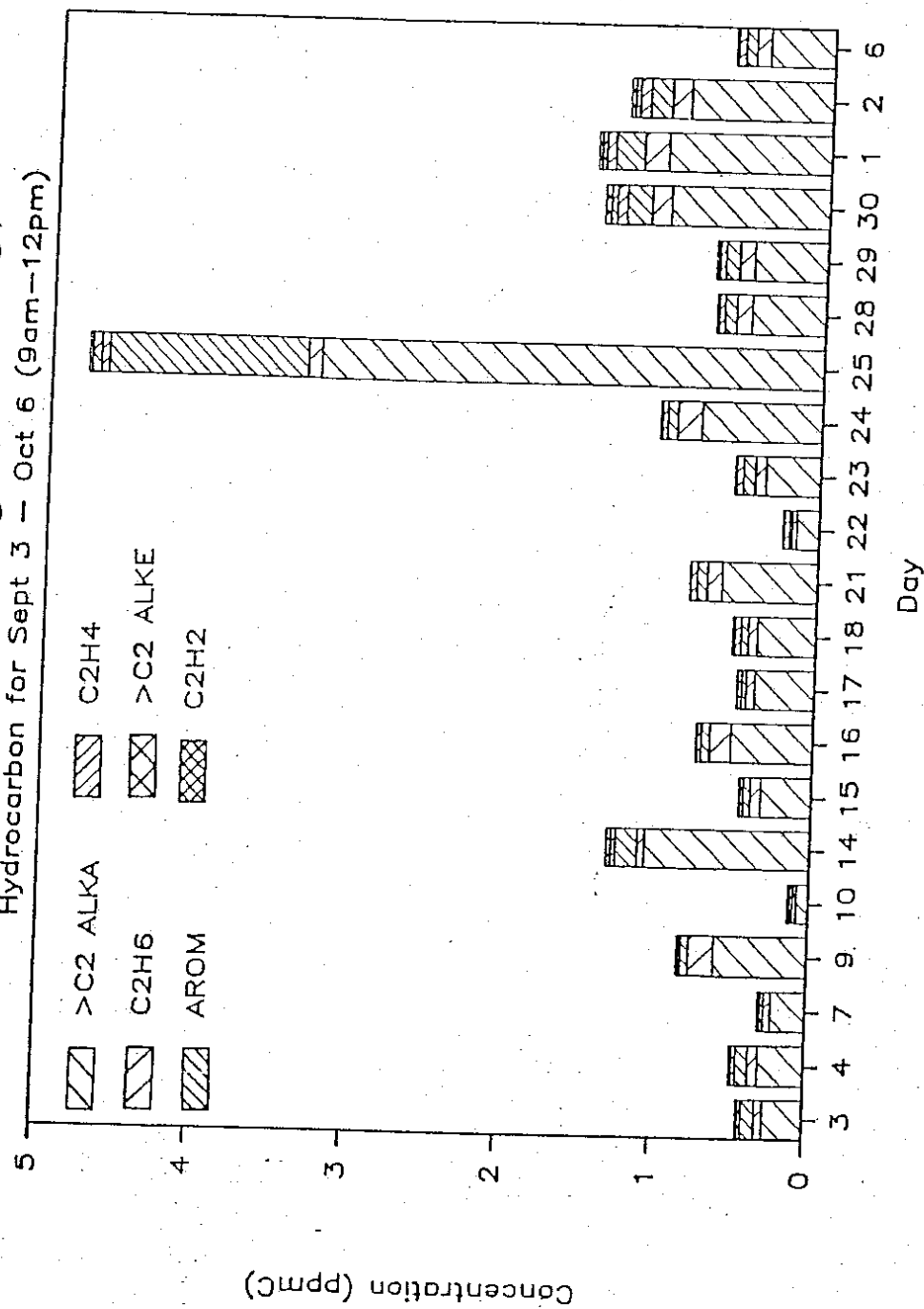
Figure C-3. NMHC Concentrations Observed at El Rio in the 1980 SANBOX Study
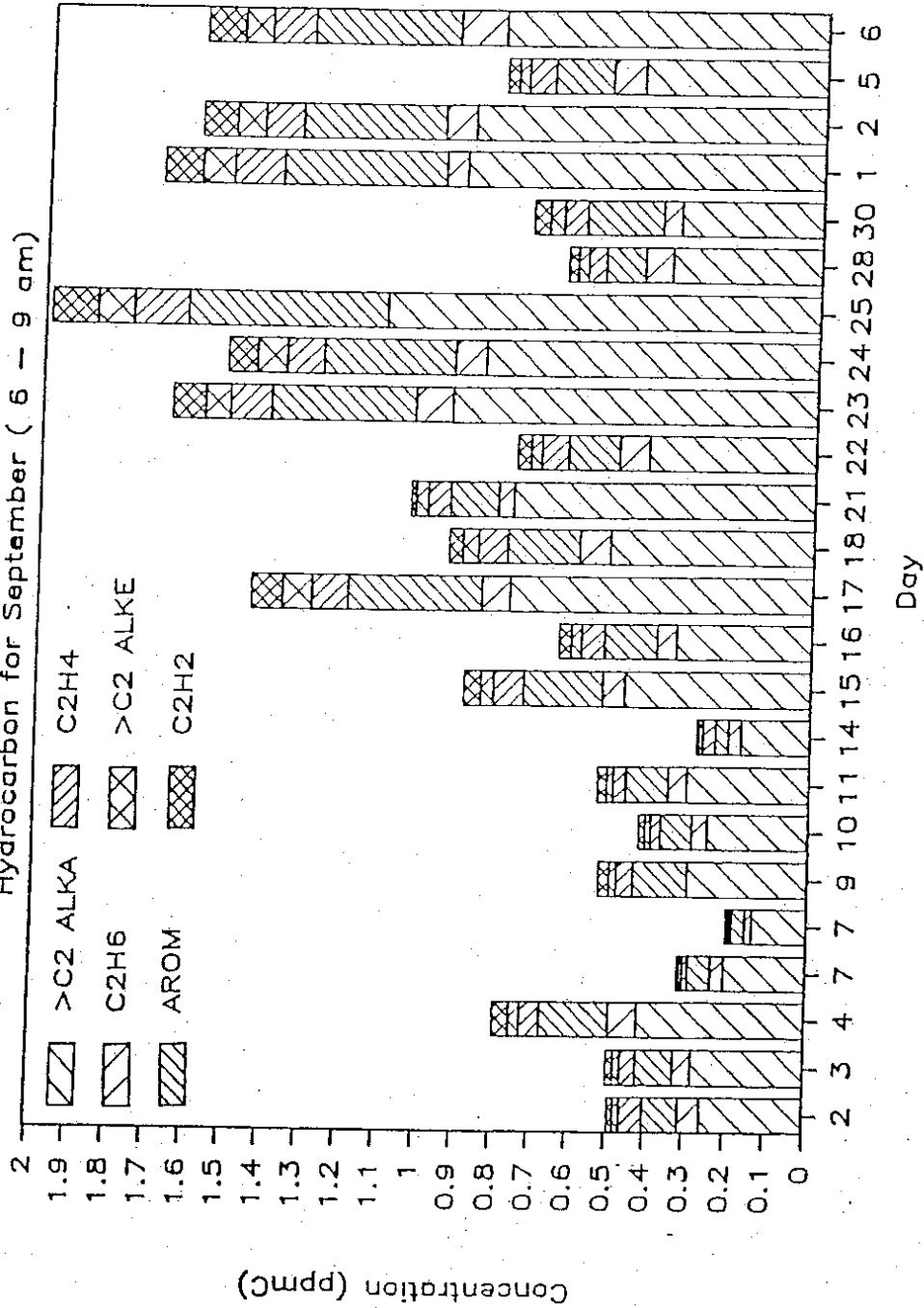
Figure C-4. NMHC Concentrations Observed at Simi Valley in the 1980 SANBOX Study
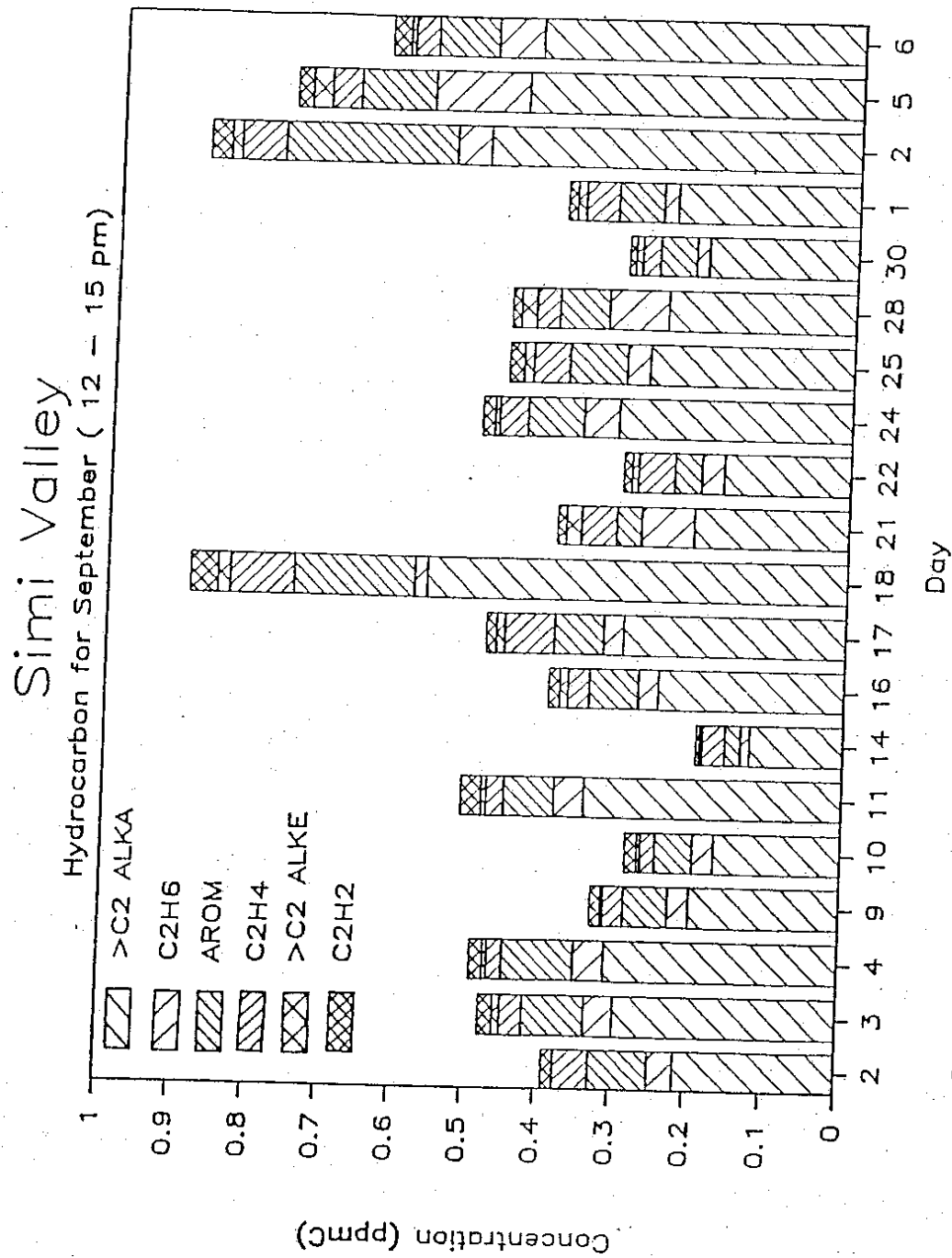
Figure C-5. NMHC Concentrations Observed at Simi Valley in the 1980 SANBOX Study
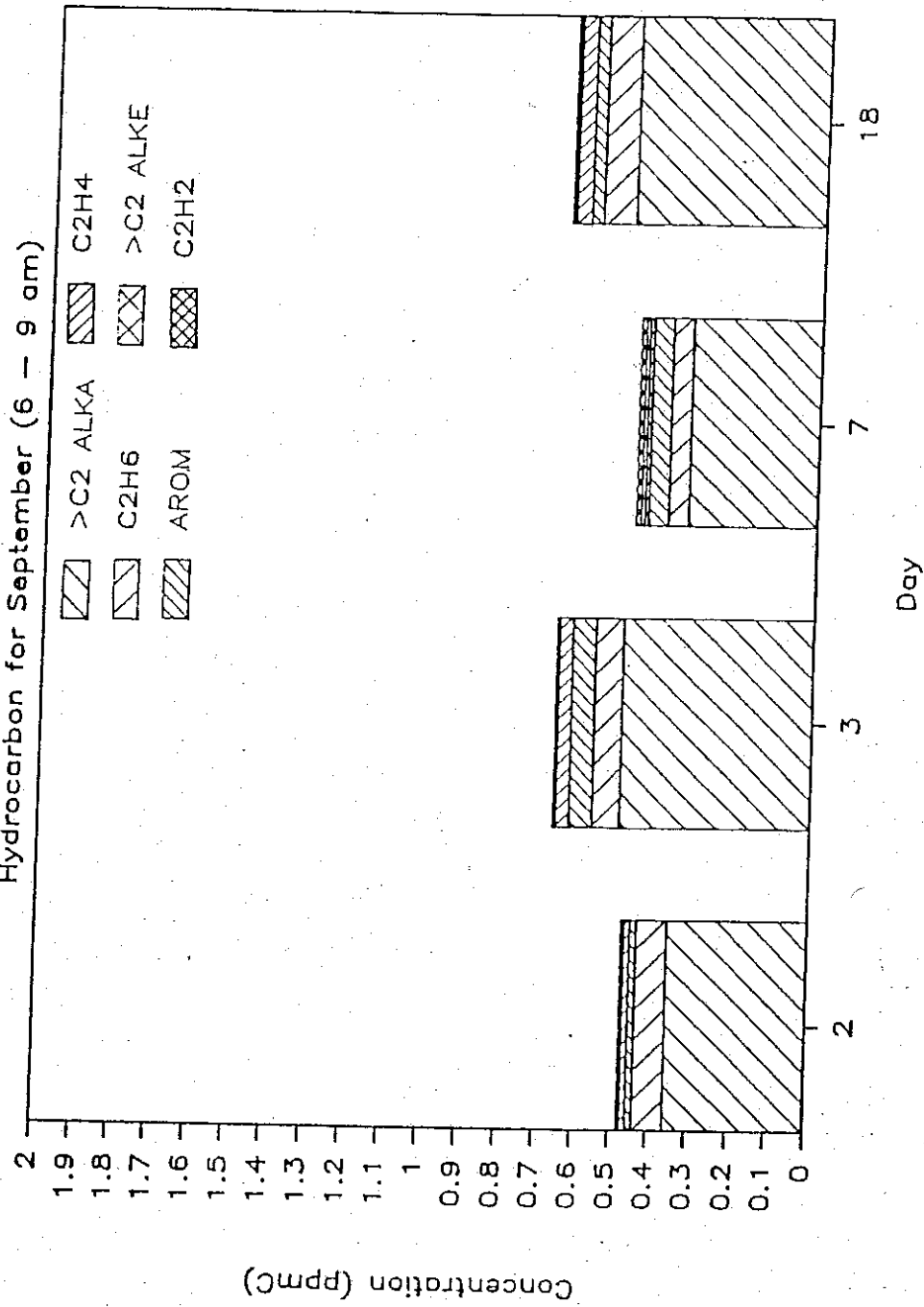
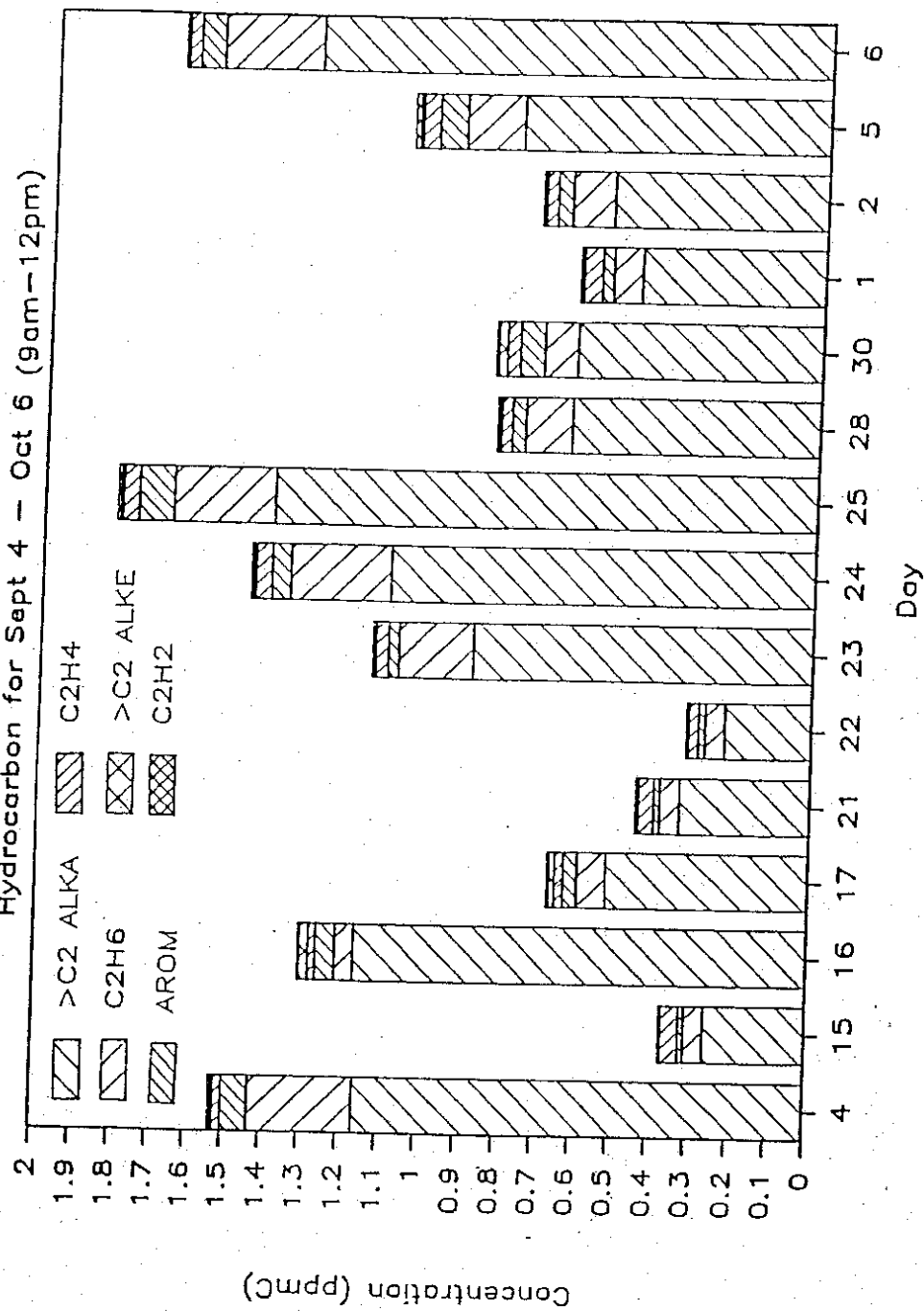Figure C-6. NMHC Concentrations Observed at Casitas Pass in the 1980 SANBOX Study

Figure C-7. NMHC Concentrations Observed at Casitas Pass in the 1980 SANBOX Study